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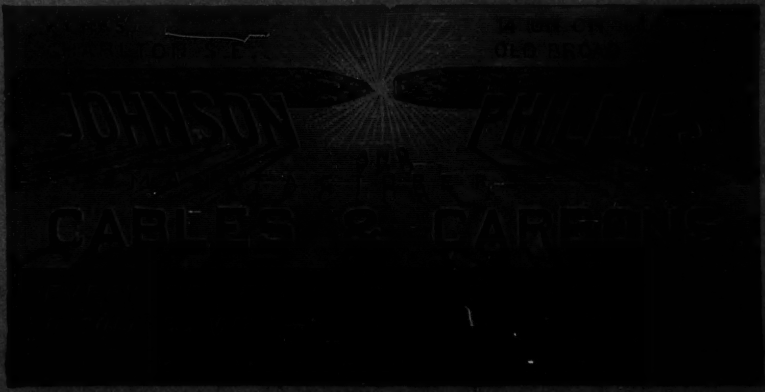

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Electrical Review.

VOL. XVI.—NO. 389.

DOMESTIC ELECTRIC LIGHTING.

WE hope to be able, in our next issue, to give particulars of an installation for three private houses, which, in its way, appears to be as nearly perfect as can well be imagined. The whole burden of superintending the erection of the plant has been most ably carried out by one of the owners of the property, and we can call to mind but one or two other instances of a private individual carrying out in all its details such an extensive undertaking, and we sincerely hope that others with the means at command, and the inclination to carry through, may find this an incentive to the more general introduction of electric lighting in the house. Respecting the prime motor, the gas engine, we need say but little; it has been found in almost all instances a good servant, not the least valuable of its traits being its readiness to commence work at a moment's notice, although we have met with more than one which, like some of our domestics, required an unlimited amount of persuasion before it would even start upon its daily duties; when once fairly under weigh it requires but little personal attendance, and when idle it does not make inroads upon its owner's purse.

The dynamo-electric machine, in like manner, may now be thoroughly depended upon to act its part in an installation satisfactorily and well, and we see no reason why a well constructed and judiciously selected dynamo should not continue in daily operation for years without repairs or renewals except of a purely minor character.

Two years ago, or even less, we should have been very guarded in anything we had to say in eulogism of secondary batteries, but such very decided improvements have been made in these apparatus that for such purposes as that to which we have referred above, they may, under periodical and intelligent inspection, even now be safely recommended, and it is not too much to assume that as they are better understood, so will further improvements follow.

Incandescent lamps have, perhaps, had more assiduous attention within the last three or four years than any other part of an electric lighting installation, and we may reasonably expect that the opinion of Mr. W. H. Preece, who looks forward to the time when we shall get one-candle power for an electrical expenditure of one watt, will sooner or later be verified.

There is, we think, one point which has generally been overlooked in the matter of electric lighting, and that is the advisability of lowering the prices of certain apparatus forming part of the necessary plant. Dynamos have been greatly cheapened by the never failing influence of competition, but the same cannot be said with respect to lamps and secondary batteries. No doubt vast sums have been swallowed up in the experimental stage of these articles, and no one can blame manufacturers for trying to recoup themselves, but this could better be effected by a large out-put at moderate and fair returns than by comparatively little trading at fancy and exorbitant prices.

There is plenty of work to be done in this country in domestic electric lighting if only contractors would be satisfied with small profits and quick returns.

THEORETICAL AND EXPERIMENTAL RESEARCHES ON THE SECONDARY GENERATORS OF GAULARD AND GIBBS.

By PROFESSOR GALILEO FERRARIS.

(*Continued from page* 394.)

SEC. 10.—*Value of the ratios m and g.*

We may before all things calculate with the said experiments the values of the ratio

$$m = \frac{q'}{Q}$$

which all other experimenters have hitherto confounded with the coefficient of total yield, and the other

$$g = \frac{r' - \rho'}{r'}\, m \qquad (47)$$

which comes from the mistaking it for the coefficient of external or useful yield.

We have, in fact,

$$Q = p\,(t - t_0)\,\frac{r_1}{R},\quad q' = p\,(t' - t'_0)\,\frac{r'}{R}$$

and thence

$$m = \frac{t' - t'_0}{t - t_0}\,\frac{r'}{r_1} \qquad (48)$$

Having m, g is also readily calculated.

We collect in the following table along with the successive number of the experiments and the values of r' relating to the same, the values of m calculated from (48), and with the registered numbers of the results of the experiments and the values of g calculated from (47) in which is put $\rho' = 0{\cdot}285$. The columns in which are registered the values of m and of g, deduced directly from the experiments, are headed m and g. Beside these are registered in two other columns headed (m) and (g) the values of m and of g calculated from an empirical formula of which I shall speak.

Values of m and of g.

No. of experiment.	r'	m	(m)	δ	g	(g)	δ
1	4·70	0·94	0·93	+0·01	0·87	0·87	0
2	5·09	0·91	0·92	−0·01	0·86	0·87	−0·01
3	6·10	0·90	0·91	−0·01	0·86	0·87	−0·01
4	6·80	0·90	0·90	0	0·86	0·86	0
5	7·73	0·90	0·89	+0·01	0·87	0·86	+0·01
6	10·02	0·87	0·87	0	0·85	0·84	+0·01
7	10·02	0·88	0·87	+0·01	0·85	0·84	+0·01
8	12·12	0·85	0·84	+0·01	0·83	0·82	+0·01
9	15·43	0·80	0·81	−0·01	0·79	0·79	0
10	17·70	0·76	0·78	−0·02	0·75	0·77	−0·02
11	17·73	0·79	0·78	+0·01	0·78	0·77	+0·01
12	19·80	0·76	0·76	0	0·75	0·75	0
13	21·50	0·73	0·74	−0·01	0·72	0·73	−0·01

The values of m and of g shown in this table have, as is seen, the progress which was found by means of the measurements made with the electrometer and the electro-dynamometer. Within the limits of our experiments the value of m diminishes progressively as r' increases, and the value of g remains sensibly constant, while r' is comprised between 4·70 and 7·73 ohms, and diminishes then gradually when r' receives greater values. If the values of r' are plotted out as abscissæ, and those of the relation, m, as ordinates, there are found points which stand sensibly upon an inclined right line which descends towards the axis of the abscissæ, far increasing values of r'. The equation of such a right line, obtained with the data of our experiments by means of the method of least squares is

$$m = 0{\cdot}977 - 0{\cdot}011\, r'. \qquad (49)$$

If produced it cuts the axis of the ordinates at the point of the ordinate 0·977, and the axis of the abscissæ at the point of the abscissa 88·8.

The line whose ordinate represents, within the limits of our experiments, the values of g, may be deduced from that which gives the values of m by means of the relation (47). If, in fact, we substitute in this formula (47) for m, its value as drawn from (49), and remembering that ρ has the value of 0·285 ohm, we obtain the equation

$$g = 0{\cdot}980 - 0{\cdot}011\, r' - \frac{0{\cdot}278}{r'} \qquad (50)$$

and this is the equation of the line which represents the progress of the values of g.

This equation shows that the value of g is greatest when $r' = 5{\cdot}03$.

In the columns of the above table headed (m) and (g) there are registered the values of m and g calculated by means of the two empirical equations given above. The column headed δ contains the differences between the values obtained directly from each experiment and of those calculated.

On comparing now the above results with those found by means of the electrometer and the electro-dynamometer, it can be seen at once that the progress of the values of g, and hence that of m, is for resistances comprised within the limits of our experiments approximately the same for the two series of experiments. To render the comparison more clear, we may calculate by means of the equation (50) the values of g, which our calorimetric experiments have given, corresponding to the values of r' equal to those with which M. Uzel experimented, and compare the numbers found by that experimenter with those calculated. Among the experiments of M. Uzel on the great secondary generator arranged in series are comprised the limits among which are the five last calorimetric measurements. We hence make the comparison thus: we calculate from (50) the values of g corresponding to the values 5·50, 7·53, 9·00, 10·60, 12·60 of $r' - \rho'$ and write them over against those found by M. Uzel for the same values of $r' - \rho'$. We have thus the following table :—

$r' - \rho'$	g Uzel.	g calculated.	δ
5·50	0·898	0·868	0·030
7·53	0·893	0·859	0·034
9·00	0·889	0·848	0·041
10·60	0·867	0·835	0·032
12·60	0·854	0·817	0·037
		Mean	0·035

which shows that save for a difference sensibly constant and equal, in the mean to 0·035 the values of g found by means of the electrometer and the electro-dynanometer follow the progress of the calorimetric measurements. The electrometric experiments of M. Uzel, like all hitherto executed, agree with the calorimetric measurements in indicating the existence of a maximum of g for a value of r' comprised between 5 and 6 ohms; this has led to the belief that such a value of r' must correspond to the maximum of yield.

But it results from the theoretical considerations premised that the fraction, g, in no manner represents the coefficient of yield of the secondary generator—a coefficient which we have yet to determine, and which varies, as we shall see, according to a completely different law.

The difference 0·035 existing between the values of g obtained from the experiments of Uzel and those calculated by means of electrometrical experiments depends essentially on the difference in the cores of the two apparatus with which the respective experiments were made, one of which, as already mentioned, being entirely of iron, and the other of wood covered with a layer of iron wires. Such a difference between the values of g does not necessarily imply a difference in the values of the coefficient of yield, values which we shall be led to recognise as exactly equal.

SEC. 11.—*Coefficient of Yield.*

The calculation which we have made of the values of m and of g, and the comparisons to which it has given occasion, have for their sole object to make a first comparison between the results of the calorimetric experiments and those of former experiments. For the study of the efficiency of the secondary generator this has little importance, since the relations, m and g, represent neither the coefficient of yield nor any other magnitude which it is important to know for practical work. The question which is really here of interest, and for the solution of which the results of our experiments should serve, is to know what is the relation between the effective practical coefficient of yield and the theoretical coefficient of yield which we have learnt to calculate from the formulæ (36) and (37) in the first part of the present memoir.

A method of solving this question consists in calculating, by means of the values of m and with the aid of the formula (44),

$$u = \frac{m}{\sqrt{1 - \left(\frac{r' m}{\text{C}}\right)^2}} \qquad (44)$$

the corresponding values of the coefficient of yield, u, and then comparing the values of u as deduced from experiment with those calculated with the theoretical formula (36). For the determination of the value of C, it is needful to know how to make use of this formula then to employ (18) then (27), and still again and more conveniently (28) on experimenting with an open secondary circuit.

But for the calculation of our calorimetric experiments this procedure, although, as we see, perfectly serviceable, is not very convenient. In fact it is needful to record an observation which we ought to have done in describing the experiments. We noted in the description of the experiments that the motor which sets in motion the Siemens dynamo which generated the primary current set simultaneously in motion many other dynamos which were at work in the gallery of the Exhibition. And as such machines acting before the public were sometimes at work and sometimes at a standstill, the work absorbed in their complication varied continually. The inevitable consequence of this fact was that the velocity of the dynamo, and hence that of the values of T, of C, and of i_m, underwent sudden variations and sometimes rather great ones. This inconvenience was especially marked in the experiments of November 15th and 16th, since, being the last days of the Exhibition, the various exhibitors who received motive power from our steam engine could not be compelled to keep their machinery inactive. The very exhibitor of the secondary generators himself used, on those days, while the experiments were being made, his dynamo, which, as it has been said, could absorb 60 horse-power, to set in action other secondary generators. Therefore, to avoid the difficulties of absolute calorimetric measurements the determination was made on the secondary and primary circuit in two successive experiments. Thus it happens that the measured values of i_m and of r_1 were not exactly what would have been found if they could have been determined at the moment at which the calorimetric measurement was made on the secondary circuit. Hence an error which, although it has been sought to minimise by means of certain artifices described above, could not be entirely avoided.

An error made in the determination of i_m reproduces itself with the same relative value in the value of m deduced from the experiments. Hence, as the formula (44) shows, it gives place in the calculation of u to an error relatively still greater. To which comes, in addition, that caused by the variation of I and of T in the determination of the constant, C, an error which is ordinarily considerable.

We can better solve the question by making use of a formula in which appear all the magnitudes measured in each experiment, and then combined in such a manner that the errors springing from an eventual variation in the intensity, i_m, compensate each other completely.

We put, adopting the customary notation :—

$$i_m^2 = \frac{\text{I}^2}{2}. \qquad (51)$$

If the apparatus had not lost any of its intensity the primary current, i_m, will generate a secondary current of which the square of the mean intensity will be $\frac{\text{I}'^2}{2}$, and I′ will have the value which from the given value of I may be determined from the formula which we have established in the foregoing theoretical study. If, on the other hand, as we may suspect a loss of energy from the given value of i'_m, or which amounts to the same thing to the given value of I, there corresponds a less value of i'_m, and if with I′ we represent the theoretical value corresponding to I, we have

$$i'^2_m = u\,\frac{\text{I}'^2}{2}$$

where u is a fraction. Our problem is reduced to determine what fraction.

The equations (51) and (52) give

$$\left(\frac{i_m}{i'_m}\right)^2 = \frac{1}{u}\left(\frac{\text{I}}{\text{I}'}\right)^2$$

hence, according to (46),

$$\left(\frac{\text{I}}{\text{I}'}\right)^2 = u\,\frac{t - t_0}{t' - t'_0}. \qquad (53)$$

Inasmuch as $\left(\frac{\text{I}}{\text{I}'}\right)^2$ may be expressed in functions of resistances by means of the formula (27″) which we transcribe :

$$\left(\frac{\text{I}}{\text{I}'}\right)^2 = \frac{r'\,(r + 2\,o)}{r_1^2 - \rho^2} \qquad (27'')$$

and if these two values are equalised, we obtain the equation

$$u\,\frac{t - t_0}{t' - t'_0} = \frac{r'\,(r' + 2\,\rho)}{r_1^2 - \rho^2}$$

which contains only the unknown u with the temperatures and the resistances measured in the experiments. This gives

$$u = \frac{r'\,(r' + 2\,\rho)}{r_1^2 - \rho^2} \cdot \frac{t' - t'_0}{t - t_0} \qquad (54)$$

or

$$u = \frac{r'\,(r' + 2\,\rho)}{(r' + \rho)\,(r_1 - \rho)} \cdot \frac{t' - t'_0}{t - t_0} \qquad (55)$$

formulæ convenient for logarithmic calculation.

The value of u as calculated varies very little when from one part of the experiment to the other the mean intensity i_m of the primary current varies sensibly.

Suppose that the mean intensity of the primary current which during the first part of the experiment, during the measurement of $t' - t'_0$ was i_m, had varied from the first to the second part of the experiment and had assumed the value $k\,i_m$ when the measurements of $t - t_0$ and of r_1 on the primary circuit were executed. Let us see how in this case (54) must be modified so that it may give the true value of u.

If with a current of the mean intensity, $k\,i_m$, there is read off on the calorimeter a variation of temperature, $t - t_0$, with a current of mean intensity equal to i_m which existed during the first part of the experiment, there will be evidently obtained a difference of temperature equal to $\frac{t - t_0}{k^2}$. And if with a current of mean intensity, $k\,i_m$, there is required a resistance $r_2 = \frac{v_m}{k\,i_m}$ to obtain a mean fall of the potential v_m, a resistance $r_2 = \frac{v_m}{i_m} = k\,r_1$ is necessary when the mean intensity of the current has had the value i_m.

Hence it follows that to calculate in this case u with the formula (54) we must substitute in it $\frac{t - t_0}{k^2}$ for $t - t_0$ and $k\,r_1$ for r_1.

When this substitution has been made the formula becomes

$$u = \frac{r'\,(r' + 2\,\rho)}{k^2\,r_1^2 - \rho^2}\;k^2\,\frac{t' - t'_0}{t - t_0}$$

therefore

$$u = \frac{r'\,(r' + 2\,\rho)}{r_1^2 - \frac{\rho^2}{k^2}} \cdot \frac{t' - t'_0}{t - t_0} \qquad (54)$$

This formula shows that the correction to be made when k is not equal to unity, consists in dividing by k^2 the term ρ^2 of the denominator, and as in Gaulard's apparatus ρ is small, the correction is small also. In the case of our experiments $\rho^2 = 0{\cdot}078$, whilst the lowest value which can be given to r_1^2 is $(4{\cdot}8)^2$ therefore 23·04 ; hence the term upon which the correction falls will not be greater, even in the least favourable case than $\frac{1}{300}$ of the total denominator. The correction is therefore capable of being absolutely neglected if, as can, in fact, be done, we take care that k is almost as far as possible approximating to unity.

The following are the values of u found by introducing into the formula (55) the values of r', r_1, t, t_0, t', t'_0 obtained from our calorimetric experiments.

Number of experiments.	r'	u	δ	δ^2
1	4·70	1·03	+ 0·04	0·0016
2	5·09	1·00	+ 0·01	0·0001
3	6·10	0·98	− 0·01	0·0001
4	6·80	0·99	0	0
5	7·73	1·00	+ 0·01	0·0001
6	10·02	1·00	+ 0·01	0·0001
7	10·02	0·97	− 0·02	0·0004
8	12·12	1·01	+ 0·02	0·0004
9	15·43	1·02	+ 0·03	0·0009
10	17·70	0·95	− 0·04	0·0016
11	17·73	0·96	− 0·03	0·0009
12	19·80	1·01	+ 0·02	0·0004
13	21·50	1·00	+ 0·01	0·0001
	MEAN =	0·99	$\Sigma\,\delta^2$ =	0·0067

The mean of the values of u recorded in this table is

$$u = 0{\cdot}99 \qquad (56)$$

To see what may be the probable error of such a determination, the difference of δ is calculated from the several values of u obtained from the mean experimental results and the squares of the same difference. The sum of the squares of the differences is

$$\Sigma\,\delta^2 = 0{\cdot}0067.$$

Whence it is deduced that the mean error of the several determinations is

$$\sqrt{\frac{0{\cdot}0067}{12}} = 0{\cdot}02$$

and that of the mean

$$\sqrt{\frac{0{\cdot}0067}{12 \times 13}} = 0{\cdot}006.$$

Hence the probable mean error is 0·004.

We may hence conclude that the second cipher of the value (56) of u is certain.

We may now calculate the coefficients of practical yield. For this purpose it is sufficient to calculate the coefficients of the theoretical yield by means of the formulæ (36) and (37), and then to multiply by 0·99.

But in order to make this calculation it is necessary to have first determined the constant, C.

(*To be continued.*)

THOMPSON AND JOLIN'S TELEPHONIC APPARATUS.

THE telephonic apparatus recently patented by Professor Silvanus Thompson and (a portion) by Mr. P. Jolin, relates to transmitters, receivers, and telephonic circuits. The transmitting apparatus is of the type described in our issue for April 25th, page 368, and which Professor Thompson claims does not contain a tympan or diaphragm, and, moreover, which consists of a combination of sound reverberators or reflectors with electric current regulators, in which a mouth tube or mouth-piece is employed for the purpose of intercepting the moisture of the breath. Recent improvements have for their object the perfecting of the instruments of the types so described, so as to render them both more certain in their action, simpler in construction, and louder in their effects. One feature of the improvements is constituted by a novel and peculiar form of electric current regulator to be employed, as previously described and claimed, in combination with a sound reverberator, reflector, mouth-piece, or mouth-tube. This novel form of "Transmitter" is called, for the sake of distinction, a "nest telephone." It may be constructed as follows:—A nest is prepared from cotton wool, lamb's wool, flannel, felt, waste silk, glass wool, slag wool, bran, feathers, flocks, hair, or other suitable material, placed in or on a suitable and solid support. In or on this nest is placed one or more lumps of conducting matter forming the electrode or electrodes of the current regulator. The electrodes may be made of any of the substances used as electrodes or contact pieces in telephonic transmitters. They may be metallic, as, for example, made of or covered with the metals osmium or selenium, or in some cases of nickel; or they may be made of some non-metallic substance, provided that non-metallic substance be a good conductor of electricity, such as a battery coke or retort coke.

FIG. 1.

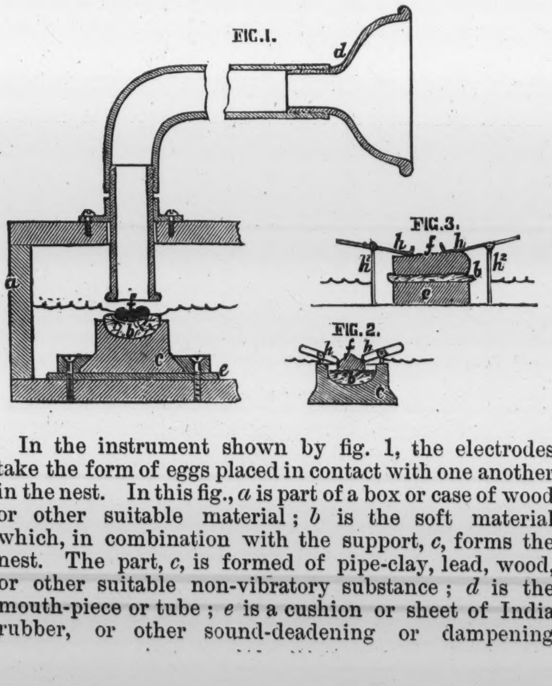


FIG. 3.

FIG. 2.

In the instrument shown by fig. 1, the electrodes take the form of eggs placed in contact with one another in the nest. In this fig., *a* is part of a box or case of wood or other suitable material; *b* is the soft material which, in combination with the support, *c*, forms the nest. The part, *c*, is formed of pipe-clay, lead, wood, or other suitable non-vibratory substance; *d* is the mouth-piece or tube; *e* is a cushion or sheet of India rubber, or other sound-deadening or dampening material, such as is used in many optical instruments, to prevent or neutralise the effect of the false vibrations of any part of the instrument, or of its case, upon the contact pieces in the nest.

One advantageous form of the nest telephone is obtained by placing, in the middle of the nest, a single lump of coke or metal in combination with some other pieces of suitable material, resting upon its edges, as shown by fig. 2; in this case, the arrangement of the cell or cells of the battery circuit and connections is such that, when the apparatus is working, the current shall flow through the points of contact where one or more of the pieces or lumps touches another of the same.

In fig. 3, *f* is a cinder or piece of coke lying on the nest and in contact with the levers, *h*, which are pivotted on the wire supports, h^2.

The "Receiver" is of the kind described in the *English Mechanic* of August 11th, 1876, page 551, that is to say, it is an instrument having an armature carried on or by a membrane or drumhead, and is so designed as to make its sensitiveness and efficiency as great as possible.

The inventors use a compound diaphragm or drumhead, made by placing between two membranes an armature formed of magnetic material, such as a piece of clock spring or iron. In order to keep the membranes as taut as possible, the inventors enclose between the latter a light frame, which may be square, hexagonal, or of other suitable shape, and formed or cut out of metal, ebonite, or other non-absorbent material; this frame assists in straining or stretching and supporting the membrane, and renders it so stiff that tying down may be dispensed with; in fact, the compound drumhead may be used without stretching in very much the same way as a metallic plate is used. The membranes are united by means of glue, Canada balsam, or other suitable cement, and before the uniting cement is hardened the membranes are pressed into a mould or die. After the hardening of the drumhead it may be impregnated from its under side with linseed oil, stearine, or similar material.

FIG. 4.

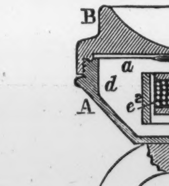
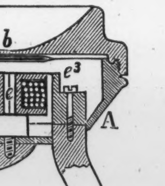


FIG. 5.



Figs. 4 and 5 show the drumheads formed of membranes enclosing an armature as above described.

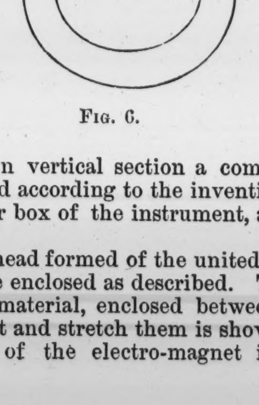


FIG. 6.

Fig. 6 shows in vertical section a complete instrument, constructed according to the invention.

A is the case or box of the instrument, and B is the cover.

a is the drumhead formed of the united membranes, *b* is the armature enclosed as described. The frame of metal, or other material, enclosed between the membranes to support and stretch them is shown at *c*.

The body, *e*, of the electro-magnet is preferably curved as shown, so that it may serve as a handle for the instrument. One pole serves as a core, e^1, to receive the coil, e^2, and is slit to prevent internal inductions. To the other pole is attached a Y-shaped or C-shaped pole piece, e^3, which is bent around but does not completely enclose the coil.

In electro-magnetic telephone instruments, that is to say, instruments in which there is an electro-magnet excited by a battery in the main circuit or line wire, the difficulty found hitherto in working in induction circuits arises from the lack of sensitiveness of the instrument, and this in turn is chiefly due to the high resistance of the wire ordinarily used on the line, the effect of which is to diminish the initial current in the receiver coil, which current should be sufficient to magnetise the core of the electro-magnet somewhat strongly. To obviate this difficulty and attain the requisite sensitiveness of the instrument without being obliged to use an inordinate number of cells, Prof. Thompson connects with the line wire a loop or shunt circuit, as shown in fig. 7, extending from a point, P, in the line anterior to the line battery, Z, Y, through an electro-magnet to a point, Q, posterior to the receiving telephone, R.

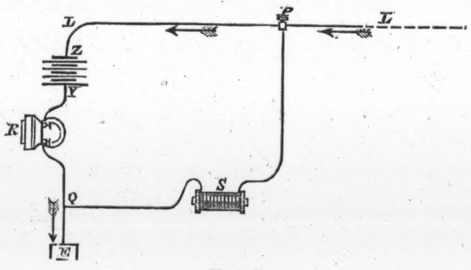


FIG. 7.

If this shunt circuit were merely a shunt with a resistance of more or less value or amount it would not satisfactorily serve the purpose, for although it would by reason of its greater or less resistance allow a considerable part of the battery current to run through it, thereby causing an increased current through the receiver and ensuring an adequate magnetisation of the core of its electro-magnet, yet it would not fully serve the object in view, because the "working currents" or "voice currents" coming through the main line would be partially diverted into the shunt, and would, without passing through the receiver, leak through the said shunt to earth. The inventor therefore inserts in this loop circuit an electro-magnet, S, constructed with a large number of turns of wire surrounding an iron core to ensure the required coefficient of self-induction, in order that, by its great electric inertia, it will block or "plug" the loop or shunt circuit with respect to the rapidly fluctuating telephonic currents and ensure their traversing the main line, the battery in the main line and the receiver, which is also in the main line.

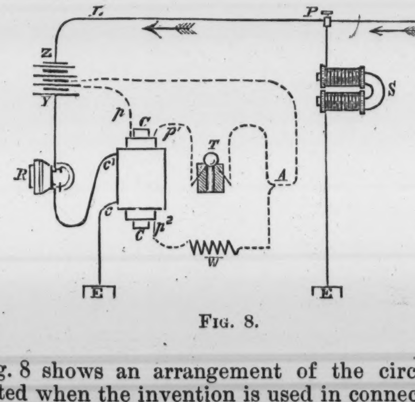


FIG. 8.

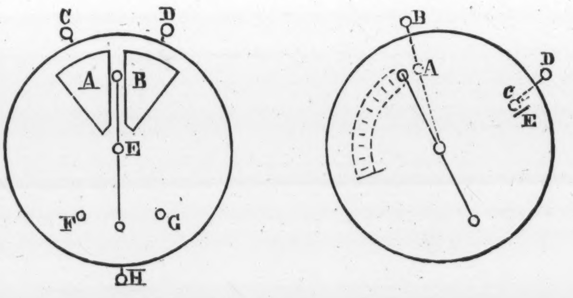
Fig. 8 shows an arrangement of the circuit to be adopted when the invention is used in connection with the "Valve" telephone (ELECTRICAL REVIEW, April 25th). In this fig. the main circuit or line wire, L, the position of the battery, Z, Y, and the connection of the loop or shunt circuit with the point, P, are the same as in fig. 7. C, is an induction coil; T, is the transmitter. The line circuit is through the battery, Z, Y; the receiver, R, and the secondary wire, c, c^1, of the said induction coil to earth; the transmitter circuit starts from the battery, Z, Y (part of which is utilised for the primary circuit), and divides preferably into two branches; one branch extends through p, p^1, and through the transmitter, T; the other branch extends through p, p^2, and through a compensating resistance, W. These two branches, which form a double primary of the induction coil, C, re-unite at A, whence the circuit returns to the battery.

SIMPLE ELECTRICAL APPARATUS.

AT the last meeting of the Physical Society, two simple pieces of apparatus were exhibited by Dr. W. Marshall Watts. One of these instruments is a modification of the quadrant electrometer.

It consists of a circular plate of ebonite standing on feet, and covered by a glass shade.

A small brass needle, terminating in little brass balls, is balanced on a point at the centre of the disc, on an agate centre. The one end swings between two brass balls, F and G, standing up a short distance above the disc, and *both* connected with a ball, H, projecting from the under side of the disc. The other end of the needle moves over two plates of metal, A and B, severally connected with projecting knobs, C and D. To use the instrument, a charge of known sign is communicated to the knob, H, and the needle, after a few oscillations, comes to rest midway between F and G. The instrument is sufficiently delicate to give a decided deflection when C and D are connected with the plates of a small bichromate cell.



The second instrument may be regarded as a modification of Peltier's electrometer. It also consists of a disc of ebonite, having a needle point in its centre, on which turns a little needle, terminating in brass knobs; but the arms of this needle are of steel, and magnetised; and the cap is metal, and not agate. The directive force of the earth (or of a directing magnet fixed on the cover of the instrument), may be made to bring one end of the needle in contact with the fixed knob, A, which is in metallic connection both with the centre on which the needle turns and with a projecting knob, B. When a charge is communicated to B, the needle is repelled a greater or less distance, which is measured by a little graduated arc. The nature of the charge may be determined by turning the instrument round, so as to bring the needle nearly into contact with a different knob at E, which is connected to a projecting knob, D. The needle is prevented from coming into actual contact with C by a little ebonite stop, E. If the charge is +, the needle would then be repelled when a positively charged body is brought near D; and if —, then when a negatively charged body is brought near D.

RECKENZAUN'S ELECTRO-MOTORS.

IN the table below will be found the results of some tests made with several of these electro-motors. They may prove interesting to those who make a study of this kind of apparatus, for we believe that such complete experiments carried out in a systematic manner have not before been attempted.

RECKENZAUN'S 50 lbs. 30-VOLT MOTOR.

Resistance between Terminals ·248 *ohms.*

Revolutions per minute.	Current in Ampères.	E.M.F. Volts.	H.P. on Dynamometer.
1,140	31·7	20	·41
1,570	26·1	21·6	·43
1,986	20·9	21·6	·36
1,384	34	23·1	·5
1,718	27	23·1	·46
2,182	20·9	24	·39
1,380	41	26·4	·63
1,660	35	26·4	·6
2,040	27·7	26·4	·56
1,626	42·4	30	·78
2,040	36	30	·74
2,220	33	30	·71
1,984	47	34·5	1·00
2,348	37·2	34·5	·85
2,350	46·4	38	1·17
2,264	50·3	40·3	1·30
Running without Load.			
280	3·8	1·9	0
906	4·4	4·0	0
1,538	4·8	5·7	0
2,280	4·9	7·7	0

RECKENZAUN'S 50 lbs. 60-VOLT MOTOR.

Resistance between Terminals ·78 *ohms.*

Revolutions per minute.	Current in Ampères.	E.M.F. Volts.	H.P. on Dynamometer.
992	15	33	·27
1,276	12	33	·23
1,790	7·9	33	·17
894	21	41·8	·4
1,226	15	41·8	·34
1,598	11·1	41·8	·3
1,254	18·3	47·2	·5
1,488	14·7	47·2	·42
2,016	10	47·2	·28
1,424	22·5	52·3	·65
1,684	18	52·3	·61
1,970	15·3	52·3	·53
1,818	21·4	60	·82
1,926	19	60	·71
2,342	15·6	60	·54
1,884	26	67·6	1·02
2,058	22·5	67·2	·93
2,348	19·4	67·2	·85
2,522	15·6	66	·70
Running without Load.			
260	2·7	3·9	0
846	2·7	8·00	0
1,506	2·9	11·7	0
1,840	2·9	14·3	0
2,008	3	16·4	0
2,442	3·4	20·3	0
2,566	3·57	22·4	0

RECKENZAUN'S 124 lbs. 70-VOLT MOTOR.

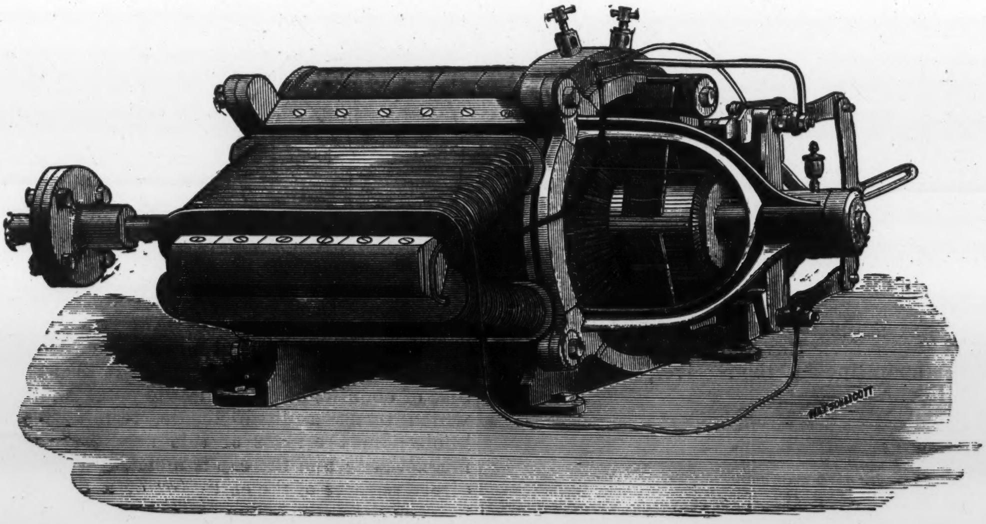
Resistance between Terminals ·564 *ohms.*

Revolutions per minute.	Current in Ampères.	E.M.F. Volts.	H.P. on Dynamometer.
1,158	24·8	43·3	·86
1,208	26·6	47·3	·98
1,436	25·6	53·3	1·07
1,774	27·2	63	1·44
1,724	39·4	70	2·13
1,824	34·7	70	1·99
1,936	31·7	71·6	1·84
2,044	30·3	71·6	1·8
2,096	27	71·6	1·7
2,184	26·2	71·6	1·54
1,430	47	71·6	2·3
1,554	47·6	76	2·4
1,736	48·4	85	2·61
1,931	50	95	2·87

RECKENZAUN'S 124 lbs. 120-VOLT MOTOR.

Resistance between Terminals 1·82 *ohms.*

Revolutions per minute.	Current in Ampères.	E.M.F. Volts.	H.P. on Dynamometer.
984	19·2	85·2	·99
1,548	9·8	85·2	·78
1,854	7·4	85·2	·55
1,048	19·9	94	1·14
1,480	12·5	94	·94
2,078	7·4	93·2	·6
1,288	22·5	100	1·5
1,640	16·2	100	1·34
2,040	11·3	101	·93
1,458	22·3	110	1·72
1,782	16·5	110	1·45
2,092	10	110	1·14
1,751	22·2	122	1·94
1,980	16	122·4	1·6
2,105	13·1	123·5	1·49
1,730	25·1	133·8	2·36
1,936	19·2	133·5	1·94
2,078	16	133·4	1·76
Running without Load.			
334	1·7	7·6	0
548	1·7	11·6	0
692	1·7	13·6	0
922	1·9	17	0
1,120	2	21·5	0
1,368	2	27·5	0
1,556	2·1	31·2	0
1,796	2·1	35·6	0
1,912	2·2	37·5	0
2,092	2·2	43·6	0



RECKENZAUN'S ELECTRO-MOTOR.

The figures are the more interesting since the tests refer to similar machines of similar weights and dimensions, but wound differently; they therefore show experimentally the effect of the internal resistance upon the speed.

It will be observed that with a constant load the current is practically constant, and the speed varies with the E.M.F., and, again, with a constant E.M.F. the current rises in proportion to the increase of the load or dynamometer H.P.

Considering the small weight, as compared to the actual H.P. given out, the efficiency of these motors is very good indeed. Strength and stability are obtained by a judicious arrangement of materials. The field magnets resemble a parallelogram; longitudinal tie-bars screwed to the magnets, are provided with bosses to which the bearing brackets, carrying the spindle, are secured, and the whole forms a light but rigid structure whose shape cannot be distorted by ordinary means.

The armature is built up of a large number of soft iron links, each link having angular projections outwards; these links are joined by pins as in a pitch chain, and the complete core represents a prism of any desired number of sides, with points projecting. There are from 300 to 3,000 (according to the size of the armature) of such links. The ventilation through the armature is complete, and, therefore, large currents can be employed with wires of comparatively small sectional area.

There is practically no sparking at the commutator, no matter at what speed the motor runs.

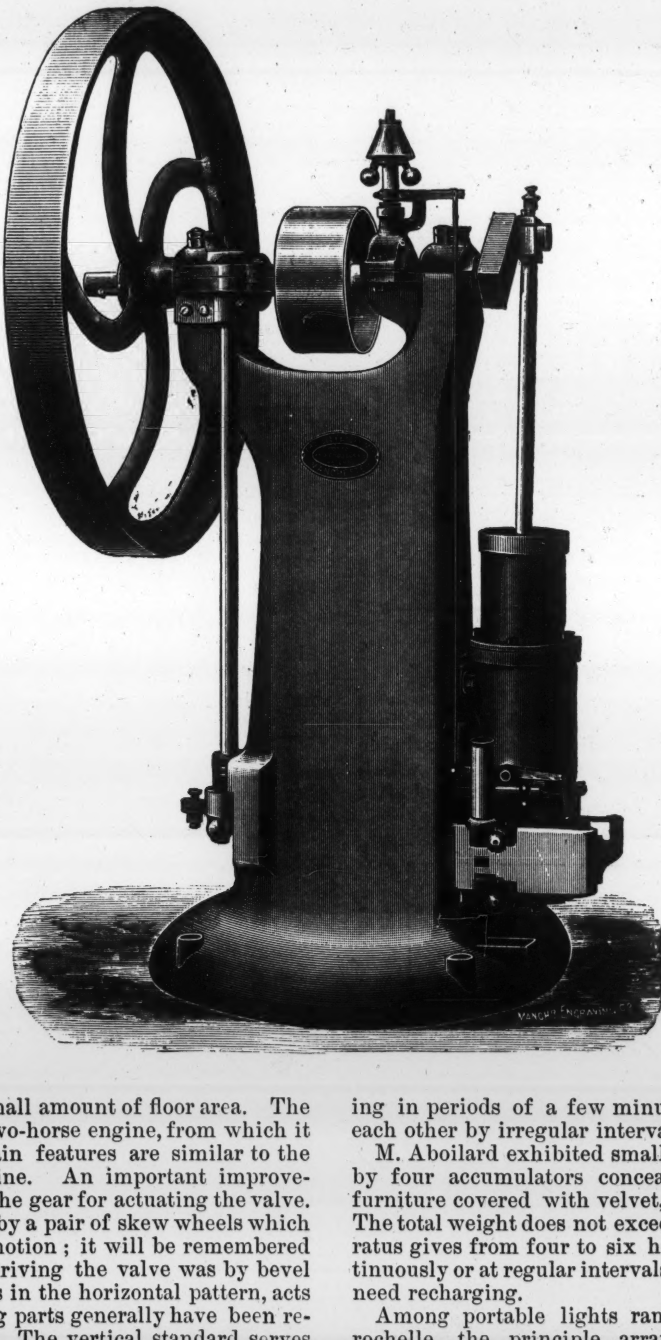
These motors have found favour with Professor

Fleeming Jenkin for telpherage, also for driving ventilating fans in India in place of the old punkahs; also, as our readers are aware, for electric launches, tram cars, and for driving machinery.

THE VERTICAL OTTO GAS ENGINE.

Messrs. CROSSLEY BROTHERS, Limited, Manchester, have found the desire for economy with regard to engine room to be so prevalent, that they have been led to design and introduce a new form of gas engine, of which the *Mechanical World* gives this description:—

The engine is a vertical one, self-contained, and occupies a remarkably small amount of floor area. The engraving represents a two-horse engine, from which it will be seen that the main features are similar to the ordinary horizontal engine. An important improvement has been made in the gear for actuating the valve. The latter is now driven by a pair of skew wheels which give a perfectly silent motion; it will be remembered that the old method of driving the valve was by bevel wheels. The governor, as in the horizontal pattern, acts directly, and the working parts generally have been reduced as far as possible. The vertical standard serves as a water cistern, and communicates with the cylinder jacket by means of the two feet of the latter, which arrangement secures a good circulation of water, and dispenses with the ordinary tank required by the horizontal engine. The engine is made in sizes varying from half to two nominal horse-power, the latter indicating about four horse.



APPARATUS FOR INCANDESCENT ELECTRIC LIGHTING.

IF really novel and original inventions have been wanting in the recent Electrical Exhibition in Paris, we have, says *La Nature*, been able to see at least a certain number of improvements and new arrangements calculated to render the applications of electricity more numerous by the convenience, ease, and simplicity of use of the apparatus exhibited.

Among the portable lamps we may mention the apparatus of M. Trouvé, the chief defect of which is that they do not yield a light of sufficient duration and constancy. They serve especially for intermittent lighting in periods of a few minutes only, separated from each other by irregular intervals of rest.

M. Aboilard exhibited small boudoir lamps, supplied by four accumulators concealed in a large piece of furniture covered with velvet, like a lady's work-table. The total weight does not exceed 10 kilos., and the apparatus gives from four to six hours of light, either continuously or at regular intervals, before the accumulators need recharging.

Among portable lights rank the lamps of M. Larochelle, the principle arrangements of which are shown in fig. 1. The battery is concealed in the stand of the apparatus. The vessel of ebonite is divided into eight compartments by radiating partitions, and forms eight elements which occupy a very small space. The eight cells contain together about 3 litres of liquid capable of yielding about eight hours of light before the solution is exhausted. Each element consists of
]

a rod of zinc and two rods of carbon. These zincs and carbons are fixed upon a disc forming a lid, and can be plunged into the liquid or withdrawn at will by working a key quite analogous to the key which serves to let the oil rise in Carcel lamps. The luminous power is regulated by letting the elements plunge more or less deeply into the liquid. When at rest the zincs are completely out of the solution. The remarkable constancy of the light is due to the solution which M. Larochelle employs, and which he has selected after a great number of comparative trials.

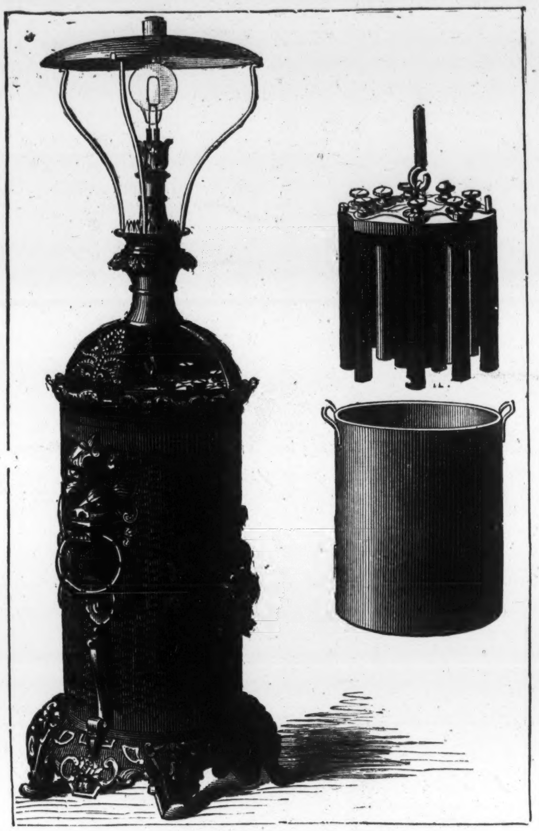


FIG. 1.

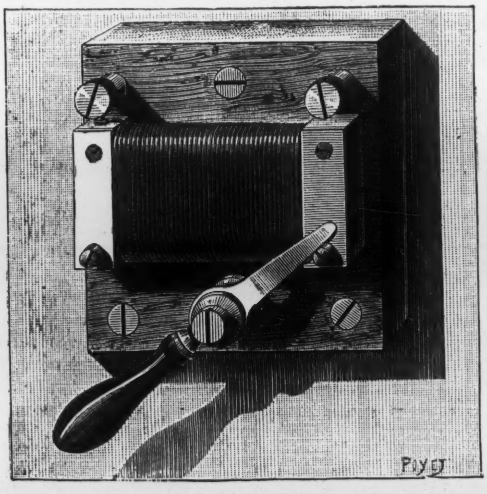


FIG. 2.

The zincs are screwed to the cover of the lamp, and their renewal is extremely simple. The replacement of the exhausted solution is also very easy and expeditious, for the battery, as a whole, can be very conveniently removed from the fittings of the lamp.

The only fault which we can find with all these portable or removable lamps is that they place in the room to be lighted the electric source containing always liquids more or less acid and corrosive. Hence they require to be managed with great care to prevent spilling the solution.

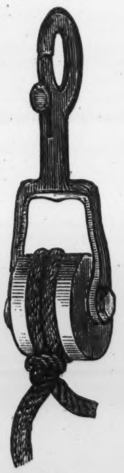
The batteries of Lalande and Chaperon give another solution of the problem, for they combine with a very intense, and relatively constant yield, the valuable advantage of consuming nothing when the circuit is open. In proportion, however, as the solution of caustic potash is exhausted, the electromotive force declines a little. This defect is remedied by making use of a number of elements a little larger than is required, and intercalating a resistance in the circuit which diminishes proportionally to the weakening of the current. A very convenient form of rheostat for this purpose is the small apparatus constructed by M. de Branville, on the design of Lalande, and represented in fig. 2.

It consists simply of a helix of wire of nickel silver coiled upon a flattened core of wood. A handle moves on the wire and enable a variable number of coils to be introduced into the circuit at will. At one of the extremities the circuit is cut, the rheostat serving as an interrupter. At the other extremity the entire helix is out of the circuit, and the resistance intercalated is nil. The same apparatus serves advantageously to compensate the inevitable inequalities of incandescence lamps, and to prevent those from being fuzed which do not present a sufficient resistance.

FLETCHER'S INSULATOR FOR SUSPENDING ARC LAMPS.

MR. JOHN R. FLETCHER, of Dayton, Ohio, has designed an insulator to meet a necessity in arc lighting, which, thinks the American *Electrical Review*, will be readily appreciated by every one familiar with the various systems now in use.

The pulley, or knob, is of the best quality porcelain—size, 2 by 2 inches—with groove in centre, to suspend either by cord, wire or wire cable. The bolt is of wrought iron, ½ by 2½ inches, and firmly secured with nut, which cannot slip off. The side arms and snap are in one piece, made from the best malleable iron, galvanised, and will bear a strain of 2,000 pounds. The weight of the insulator complete is 12 ounces.



The practical advantage of this insulator is to dispense with the use of rubber tubing and other similar insulation, which is not only expensive, but requires constant care to prevent leakages, burning of cords, and other accidents, which interfere with high electric currents such as are required in arc lighting.

This insulator is almost indispensable where lamps are suspended for outside lighting, as in using rubber tubing to insulate the cord, dampness inside the tubing causes the cord to rot, and weakens the latter to a very dangerous condition, and in many instances throws the lamp to the ground, making it not only an expensive but a very dangerous mishap.

Fletcher's perfect insulator is the only one now in use by which arc lights can be raised and lowered with wire cable, instead of cord, and prevent escape of current in bad weather. It can also be used to great advantage in attaching lamps to iron awning frames, gas pipes, or any other direct conductor, without the least danger of making a "ground." It is also desirable to use it where hooks are run into plastered walls or ceiling, as moisture in the walls or plaster takes off more or less current when the lamp is not perfectly insulated from such contacts.

The Dayton Electric Light Company, of Dayton, O., has now in use 196 of Fletcher's perfect insulators, suspending lamps both by sash cord and wire cable.

Mr. Fletcher manufactures these insulators at Dayton, Ohio.

BATTERY TESTS.

AT the Philadelphia Electrical Exhibition a number of the more recent batteries were exhibited, and the examiners' report upon them has just been published. The number examined included varieties of both open and closed circuit batteries, and the tests were principally confined to the determination of their respective electromotive forces on closed and open circuits, and their resistances.

NAMES OF CELLS.	Volts, open circuit.	Volts, closed circuit.	Internal resist. in ohms.
Standard Daniell	1·10	...	...
Leclanché Disque No. 1	1·72	1·45	1·
,, ,, No. 2	1·77	1·48	1·
Bergman's cells, average of 5	1·33	1·16	·68
Diamond Carbon No. 1	1·24	1·12	·53
Siemens-Halske No. 2	1·10	0·47	6·5
Partz's large cell No. 1	1·97	1·76	·51
,, ,, ,, No. 2	1·77	1·62	·44
,, Iron ,,	0·98	0·91	·3
,, Medical ,, No. 1	1·61	1·15	·8
,, ,, ,, No. 2	1·60	1·24	·45
Flemming's Leclanché, portable	1·07	0·42	8·
,, ,, ,,	1·47	0·62	13·5
,, Cabinet cell No. 1	1·45	0·69	11·
,, ,, ,, No. 2	1·39	0·66	11·
Leclanché Porous cell No. 1	1·69	1·06	1·3
,, ,, ,, No. 2	1·61	1·06	1·3
,, "Prism" zinc in porous cup No. 1	1·53	1·05	·98
,, "Prism" zinc inporous cup No. 2	1·55	1·05	·95
,, "Prism" free zinc No. 1	1·55	1·10	·83
,, Diamond Carbon No. 2	1·24	1·00	·47
Fitch's Chlorine cell No. 1	1·30	0·97	1·7
,, ,, ,, No. 2	1·25	0·80	2·8

It will be noted, says a New York contemporary, that the electromotive force on closed and open circuits of some of the batteries shows considerable variation, a point which, as a rule, is not treated with sufficient consideration in the arrangement of batteries.

The last column gives the internal resistance of the various cells, but it loses some of its value from the fact that the description of the cells gives no clue as regards their dimensions. A little more detailed information on this point would have put to rest any doubts that might arise regarding the size of the cells tested.

The current strength of the cells was also measured at intervals in minutes, the external resistance being generally 2·17 ohms. The current strengths determined in this way cannot be taken as the real capabilities of the cells, since it is evident that, with the same external resistance, a high resistance cell would show an inferior result when compared with a cell of low resistance, other things being equal. The results, however, within limits, give a fair idea of the constancy of some of the batteries; but it is to be regretted that time lacked to extend the tests so as to determine the life or action under more prolonged service, the actual tests not exceeding one hour for any single cell.

DEUTSCHE EDISON GESELLSCHAFT v. NAGLO BROTHERS.

ACCORDING to the official report which has reached us, this case has been decided in favour of the plaintiff. The question at issue was whether the defendants, in making and selling incandescence lamps under the German patent, No. 13071, granted to Joseph Wilson Swan, were infringing upon the German patent, No. 12174, granted to Thomas Alva Edison, and by him assigned to the plaintiffs, the Deutsche Edison Gesellschaft. The Court held that the patent No. 13071 had been granted to Swan not for "electric lamps," but only for "improvements in the production of carbon filament for electric lamps," consequently for a certain improved process for producing filaments for electric lamps. If this patent can only be carried out by the simultaneous use of Edison's previous invention, Swan's patent is then commercially dependent upon Edison's patent; in other words, Swan cannot use his own improvements in Germany without Edison's permission. The question is whether in this case the working of the patent No. 13071 involves an infringement of No. 12174. The Court is opinion that the manufacture of Swan lamps infringes upon claim No. 1 of Edison's patent, in as far as this claims as an essential part of the invention the "formation of a thread-like luminous body for electric lamps by the carbonisation of cotton threads or other fibrous material [linen threads, wood fibres, paper], or a paste of tar and lamp black, or graphite or charcoal. The idea of the invention consists in the production of a thread-like, light-giving body of carbon, obtained by charring cotton fibres, &c., and which can be bent into a spiral form, which approaches metals in toughness, but resists the action of far higher temperatures, and possesses an electric resistance which permits of the distribution of the electric current. *The pleas of the defendants, that this alleged invention of Edison's is not novel, and that the lamps produced according to the patent* 12174 *are not practically useable, is not relevant to the case in question, and belongs to the suit now in progress for annulling the Edison patent.*

The lamps which the defendants are uttering contain unquestionably a luminous body, obtained by carbonising a cotton thread, bent into the desired shape. This is an infringement of the plaintiffs' patent. Swan's method of parchmentising the cotton thread before carbonising may be an improvement on Edison's procedure, but it does not justify the use of the latter without Edison's sanction. On these grounds defendants are sentenced to abstain from manufacturing, importing, or selling electric glow lamps made under Swan's patent 13071. The plaintiff's claim for damages is rejected, since according to section 34 of the German patent law only those persons can be condemned in damages who "knowingly" infringe upon a patent; and in view of the difficulty and dubiousness of the questions at issue, it cannot be assumed that the defendants, Naglo Brothers, were aware that they were committing a breach of the law.

[It should be remembered that the terms "improvement," "improved method," &c., used in English patents cover not merely the German term, "Verbesserung"—the literal translation—but also the term, "Neuerung." Judging from an expression used by the Court, it would be safer, in translating English patents into German, to use the latter term.]

Death of Anson Stager.—General Anson Stager, who recently died at his residence in the city of Chicago, was well known in telegraph circles, in which he had been prior to 1881 (when he resigned as a Vice-President of the Western Union Telegraph Company) a prominent character for upwards of a third of a century. He left three daughters. The appraisers have valued the estate at $850,000, viz., real estate to the amount of $125,000, and personal property amounting to $725,000. The estate is to be equally divided.

WEST AFRICAN CABLES.

We learn that a Bill which passed its final stage in the Portuguese Cortes last Friday week grants concessions for a system of cables from St. Vincent to Africa and along the African coast, linking together the various ports. This Bill gives landing rights at the most important Portuguese possessions, and further guarantees to the concessionaire an annual amount of traffic, not less than £42,000. Besides these facilities, the cables will have peculiar technical advantages, to point out which we do not think we can do better than give an extract from an able and thoughtful letter addressed to a contemporary by Sir James Anderson, whose extensive experience in cable matters gives much weight to his opinion. After reference to other matters, he goes on to say :—

"My real point in replying to this notice is to put on record once more, and as briefly as possible, what I do think should be the principles which should govern the selection of a route for submarine cables.

"*a.* Cables should be laid as far as possible where they can most easily be got at to repair.

"*b.* They should be laid in as short sections as convenient—touching at as many points as are likely in the near future to develop some traffic or commercial intercourse of any kind.

"Speaking generally, the most useful and economical lengths for cables are from 500 to 1,000 miles, and the depths which we would all select if we could would be between 300 and 1,000 fathoms.

"*c.* Cables should be laid as much as possible along the track usually selected by our mercantile marine for the two special reasons—1st., when any interruption takes place, the broken section can, until repairs are effected, be more frequently bridged over, and there are more chances of chartering a steamer to continue going between the interrupted points if the interruption seems likely to be prolonged; 2nd., and very important. In time of war the national armed cruisers appointed to patrol the track of our commercial marine would at the same time be guarding the track of the cables.

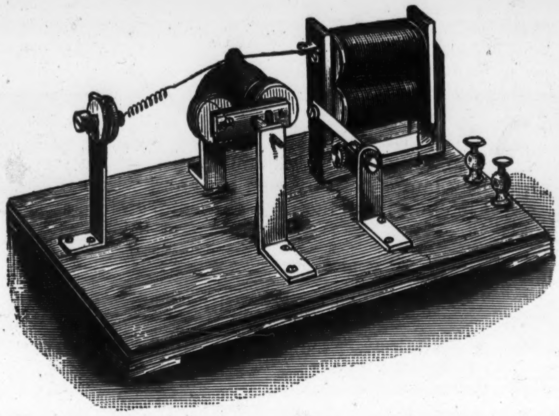
"It is all very well to lay cables across great oceans if there is no other way of getting at the points desired, but in my judgment every useful purpose is best served by cables which internationally, intercolonially, and amongst islands, touch at as many points as offer some chance of promoting commerce."

The African cables to which we refer will carry out all the above conditions, and in addition will form the means of assuring our communication with the Cape; for the present line along the East Coast of Africa, singularly enough, does not fulfil any of the conditions enumerated above, and is consequently the subject of continual anxiety and occasional interruptions.

The proposed cables will also have all the protection which an international character can give them, as they may be used in connecting up French, Spanish, and German settlements.

BAYLEY'S ELECTRO-MOTOR.

This apparatus, a model of which is shown by the fig., is, we believe, an entire novelty in electro-motors, and is in principle a most ingenious invention. It consists of a vibrating armature which is actuated on the make and break principle employed in ordinary electric bells. The movement of this armature causes an iron disc to oscillate through a small angle on its axis. On another axis coincident with that of the iron disc is fixed an electro-magnet whose poles are in close proximity to the face of the disc. Now if the electro-magnet were permanently excited it would adhere to the disc, and if the latter were rotated, then the magnet would be carried round with it and thus the axis on which the latter is fixed would also rotate. If, on the other hand, the disc only oscillates (as is actually the case), then the electro-magnet would only oscillate in unison with it. But further, if after the disc has oscillated in one direction the electro-magnet ceases to be excited, then it will no longer adhere to the disc, and consequently, if the latter now oscillates back again, it will not draw the electro-magnet back with it. If the electro-magnet be now again excited it will again adhere to the disc and another forward oscillation will move the electro-magnet a little further round on its axis; so that by a constant repetition of these movements a continuous rotation will be given to the axis on which the electro-magnet is fixed. In order to make the latter become excited at the right moment, all that is necessary is to include it in the circuit of the contact breaker of the armature, as must be obvious. We may mention that the new motor may be seen at Messrs. H. & E. J. Dale's exhibit at the Inventions Exhibition.



THE INVENTIONS EXHIBITION.

The International Inventions Exhibition was opened by the Prince and Princess of Wales on Monday last, 4th May, under the most favourable auspices, and in the presence of a gathering both fashionable and distinguished. In addressing His Royal Highness, Sir Frederick Bramwell, the Chairman of the Executive Committee, referred, amongst other things, to the employment of electricity for the purposes of lighting as undoubtedly one of the most striking instances of the application of science to the purposes of daily life, and called attention to the steps that had been taken this year to render any sudden failure of the lights impossible, and to the employment for the garden illumination of the incandescent lamp on a scale never before attempted.

The Exhibition, although much remains to be done before everything is in complete order, presented a remarkably satisfactory appearance for an opening day; and the structural additions tend very much towards a compactnesss which has hitherto been wanting. A copious and comprehensive catalogue has been published, giving not merely a description of each exhibit, but introducing each group with an article by some man of eminence in that particular department of science. The part of the catalogue devoted to electricity is prefaced by a review of the progress of the science since 1860, by Professor Lodge, of University College, Liverpool, in which he remarks that "among all the inventions of the past 25 years, the most striking are no doubt the dynamo and the telephone. The fundamental principle of neither is new—both depend on electrical facts discovered by Faraday—and in both does a single scientific idea receive remarkable practical development, though in different directions. The dynamo raises the magneto-electric current of Faraday to engineering magnitude, while the telephone utilises the rapid intermittence of currents almost too feeble to be otherwise detected." Altogether there are about 150 exhibits of a strictly electrical character arranged in the space allotted to Group XIII. in the East Arcade. In addition to these, however, there are a great number of exhibits bearing on electrical matters arranged under other groups. To commence with the latter, the following may be mentioned :—In Group II. (162) will be found an exhibit of the Phosphor Bronze Company, consisting of samples of phosphor bronze alloys for bearings and parts of machinery, and silicium bronze wire for telegraph and telephone lines, electric lighting and other purposes. In Group III. (367), J. Coley, Bromfield: Improvements in the construction of pavements and roadways where it is required to accommodate telegraph, telephone and other wires, gas pipes and the like. Group IV. includes high speed engines, the manufacture of which has been greatly stimulated by the demands of electric lighting, for which purpose attention has been particularly directed to those of the rotary class, among which, the spherical engine, recently brought into prominent notice, appears likely to become a decided success. (409) Crossley Bros. show several Otto gas engines. (416) Coalbrookdale Company: The Elwell-Parker high-speed engine. (417) Greenwood and Batley: An Armington and Sims improved high-speed horizontal steam engine with patent automatic cut-off regulator. An engine of this class is used for driving the dynamos for the Thomson-Houston installation in the east gallery. (423) Heenan & Froude: A Tower spherical high-speed engine, as in use in the building in connection with the lighting of the south promenade by Messrs. R. E. Crompton & Co., and the club dining rooms by Messrs. Woodhouse & Rawson. (433) Robey & Co.: A semi-fixed compound engine specially adapted for electric lighting, and fitted with Richardson's patent electric regulator, for maintaining either a constant current or constant electromotive force irrespective of variations in boiler pressure or work done. (434) The Kirkstall Forge Company: Improvements in shafting, coupling and bearings. The shafting is rolled so straight, round, and true, that it does not require turning; 20 per cent. increase in torsional strength and 33 per cent. in flexional strength is gained; the couplings are held by friction, no keys are required, and the bearings are adjustable. (448) Deakin, Parker & Co.: The Acme high-speed governor (Lindley's patent), in sizes from ¾ inch to 5 inch steam pipe, and fitted to a vertical compound tandem electric light engine, and also to an 8 H.P. new and improved self-contained engine. Model of Lindley's patent driving gear for dynamos. Vertical engine with patent acme governor and Raworths' system of friction driving gear for dynamos in motion. (459) Willans and Robinson: Willans patent compound engines for electric light and other purposes, electric governors, &c. (460) Kitson and Co.: Parson's patent high speed engine for driving dynamo-electric machines and other purposes. (465) Young: Speed indicators. (471) George Richards and Co.: Medart's patent pulleys. It is asserted that there are over 200,000 of these pulleys at present in use. (480) Professor Ewing: Friction gear suitable for driving dynamos, &c., the gear forming a multiplying coupling between the shaft of the motor and that of the dynamo. (482) Hanson, Scott and Co.: Driving ropes such as have been largely used in connection with ship lighting. (489) Thomas Fleming, Son and Co.: Patent square leather link belting. This firm supplied the whole of the belting for the present electric lighting installation at the Crystal Palace, and a large proportion of that in use at the present Exhibition and its predecessors. (509) Charles Cannell: Electric governor for steam engines. (564) F. D. Bumsted: Chandler's high speed engine for driving dynamo machines direct or by means of rope gear. This engine was fully described and illustrated in our issue of 27th December last. (585) Goodfellow and Matthews: Matthews's patent high speed compound tandem-triplex engine for driving dynamos, &c., direct. Three engines of this type (as mentioned in our last) may be seen driving the same number of enormous Siemens dynamos at the West Quadrant side of the conservatory. In Group V., W. R. Sykes: Combined interlocking and blocking system for railways. (667) Electric Signal Company: A system of railway signalling by which the ordinary visual signs are repeated on the engine, and, as long as the semaphore is set at danger, an audible signal also is maintained on the engine. The progress of the train along the line is indicated to the signalman, and the duration of each danger signal is automatically recorded. When the train rests on the line any message may be sent to or from it. Group XXV. (1885) Nordenfelt: New electric torpedo. (1888) The Maxim Machine Gun: Not an electric exhibit, but interesting as the invention of Mr. Hiram Maxim. In Group XXVI. (2049) Paper Cutting and Reeling Company: Endless paper coils for Wheatstone, Morse, Hughes, and other instruments. Group XXVII. (2086) Grimshaw and Baxter: Lathes and mandrils as used by telegraph instrument makers. (2113) An English Keyless Lever Watch, with a specially-designed dial, showing the code letters, for the use of postmasters and telegraphists. (2102) Society Chronos (Mayrhofer and Otto); Anti-electro-hydro-pneumatic clocks. (!) (2108) Standard Time and Telephone Company: Synchronised clocks and clocks fitted with contact springs to ring a series of electric bells at any stated times. And in Group XXVIII. (2128) James Wimshurst: Large electrical influence machine with plates 7 feet in diameter, laboratory machine with plates of 18 inches diameter, &c. (2150) A. B. Harding: Harding's Magnetophone for rendering audible the magnetic lines of force, and Edison's Phono-Motor for *talking a hole through a board.* (2152) W. Groves: Electrical speed indicator and transmitter. (2195) A reflecting tangent galvanometer indicating values of current upon an equally divided straight scale without calculation.

Having thus indicated what is worthy of notice outside of Group XIII., we purpose in following issues giving a brief description of the electrical exhibits proper, in the order in which they are arranged in the East Arcade, leaving over fuller details of novelties connected with the electric lighting till that department is in a more complete state.

The Society of Telegraph Engineers and Electricians.—The next meeting, at 25, Great George Street, will take place on Thursday, May 14th, 1885, at 8 p.m., when a paper on "Electrical Definitions, Nomenclature, and Notation," will be read by Principal Andrew Jamieson, F.R.S.E., member.

NOTES.

The Electric Light in the Royal Navy.—Orders have been issued from Whitehall directing H.M.S. *Active*, at Portsmouth, to be supplied with the Victoria dynamo and the Brotherhood engine for the production of electric search lights. The contractors have been requested to furnish a sketch showing the deck space and height required for the apparatus, and it is desired that the wires shall, if possible, be laid below the water line, and the projectors placed as far out on the bridge as possible.

The *Imperieuse*, also at Portsmouth, is to be fitted with the electric light, having similar fittings and switches to those lately supplied to the *Edinburgh*.

Commander Conybeare, assistant to the Director of Ordnance, paid a visit to Devonport Dockyard on Friday last week, during which, he selected the positions for the electric search light and dynamo on board the gunboat *Tay*. Later on he visited the newly-named *Woodcock* (late *William Jolliffe*), and the *Magnet* (late *Knight of the Cross*), and made arrangements for the reception of similar apparatus.

Messrs. R. E. Crompton and Company have been instructed by the Admiralty to make seven more sets of electric light machinery for ship use, and 20 more projectors.

Electric Lighting in Belfast.—During the visit of the Prince and Princess of Wales to Belfast, the following places were illuminated with the electric light: The Royal Ulster Works (Marcus Ward & Co., Limited), printers and lithographers, had the front of their establishment decorated with four venetian masts, from each of which was suspended a 2,000 C.P. arc lamp, which at night brilliantly illuminated the front and side decorations of the building. Messrs. Marcus Ward & Co., also kindly supplied the power for the large arc lamp placed on the bicycle arch. Messrs. Kirk & Partners, Donegal Square, displayed two large arc lamps supplied by an Oppermann dynamo, driven by a 3½ H.P. "Otto" engine on the premises communicating. The tower of the old Poorhouse, on the Crumlin Road, was also illuminated by a large 8,000 C.P. arc lamp; the height to which this lamp was raised made its brilliant light seen for miles around the country. Messrs. John Rodgers of Victoria Street, displayed a very unique device consisting of a large globe of wire, about 5 feet in diameter, with thousands of panes of coloured glass, in the centre of this was set an arc lamp, which, when lit, gave an effect which has never been surpassed by any of the numerous ornamental devices used for gas or electricity. All the above lights were fitted up by C. C. MacCarthy, of Belfast, the material used having been supplied by Messrs. Oppermann Brothers, of London, Mr. MacCarthy being their agent in Ireland. Mr. H. Johnston's display was also under the management of the same gentleman; it consisted of an oval picture of the Prince of Wales, framed in 20 C.P. Oppermann lamps, the picture being suspended outside the shop above the window. We learn that the lighting of High Street failed, owing to some persons short-circuiting the wires on the roofs; at 1 p.m. in the day tests showed that all was in working order, but when the dynamos were started in the evening the cables were found to be short-circuited. The entire illuminations intrusted to Mr. MacCarthy's care were completely fitted up in less than three days. The cable arrived from England only in time to start on Monday, 20th ult., the dynamos and lamps reached Belfast on Tuesday evening, and by Wednesday afternoon two miles of cable had been run over the different parts of the town, in some cases having to pass over most uneven roofs; 19 Brush arc lamps were fitted up, and 7 dynamos unpacked, placed in position, and in some cases countershafting made, and different sized pulleys cast and fitted to the dynamos. The installations were worked from five separate stations.

The Plymouth Telephone Exchange.—The Western Counties and South Wales Telephone Company has consented to the terms required by the subscribers to the post office exchange for Plymouth, Stonehouse, and Devonport, who have been negotiating with the view of according their support to the company. The directors have, in fact, conceded everything that was asked of them, and their subscribers will, therefore, enjoy greater facilities for inter-communication than were afforded them under the Post Office *régime*. For the commercial rate of £12 per annum on all night and all day service, with free access for subscribers to all the call rooms in the three towns, and free connection with the Post Office, thereby enabling subscribers, without any charge, to send or receive their telegrams at any time of day or night, the company is willing to connect any person to the exchange, which under such conditions cannot fail to become most popular. A "domestic" rate of £10 per annum is also offered, giving a day service from 9 a.m. to 7 p.m., Sundays excepted, and free use to call rooms. Subscribers will be received on the terms of £12 for one year, £11 per annum for four years, and £10 per annum for seven years. The names of intending subscribers will be taken at once on the understanding that there shall be no payment until at least 100 subscribers have been obtained. Persons agreeing for four or seven years can cease their subscriptions at any time on paying the difference between the rate they are paying and the £12 per annum for a single year. The total liabilities of those giving in their names is therefore limited to £12. It is anticipated that little difficulty will be experienced in getting subscribers, and it is hoped that ultimately as many as 500 may be obtained.

Telephone Currents.—Prof. Chas. R. Cross described last month, before the Institute of Technology, at Boston, some new apparatus for the study of telephone currents. Telephone currents sometimes run in one direction, sometimes in another, the alternations being very rapid. To obtain indications of such currents as these, a special galvanometer had to be used. It was formed of one coil of wire inserted within another, the centre coil being kept in position by a torsion suspender. A current sent through both these coils at the same time tended to bring them both into a position of parallelism toward each other. When reversed, the current was reversed in both coils at the same time, the effect upon the centre coil being continuous, and in the same direction, according to the strength of the current, no matter how often it might be reversed. The centre coil carried a mirror reflecting a beam of light upon the wall, and as the tendency was toward parallelism or away from it, the spot of light was moved as on a scale. This experiment was tried with great success. When the loud-speaking transmitter was used, the deflection was very marked; the Bell apparatus gave results much inferior. It ought to be mentioned that the effects were only produced with single vowels, such as a, o, u and y. Judging from the results thus far obtained, Prof. Cross declared the telephone current to have an enormously greater strength than it has hitherto been supposed to possess, although we fail to see, from the information to hand, his reasons for so doing.

Electric Lighting for Coast Defences.—The Agent General for Victoria has received a telegraphic dispatch from the Government of the Colony stating that, in view of the defence of Melbourne Harbour, it may at any moment become necessary to remove the facilities now afforded for the navigation of Port Philip. In that event vessels approaching the Heads will be warned by finding the lights on Point Lonsdale and Point Nepean extinguished. No vessel will be permitted to enter between sunset and sunrise, and during this period arrangements will be made for piloting vessels. Electric lights may be exhibited at any time from Queenscliff and Point Nepean for defence purposes, but such lights must not be taken as guiding lights.

The Invention of the Bell Telephone.—In the argument of Mr. Dickerson, counsel for the American Bell Telephone Company, in the suit of that corporation against the Molecular Telephone Company for infringement, he remarked:—"It is often said, by way of criticism of Prof. Bell, that when he applied for a patent he had never actually constructed or tested the specific instrument described in his patent. Now, may it please your honour, a word on what my learned friend says about the progress of the Bell invention. He tells your honour that Bell never heard his telephone *talk* until after he got his patent. That is strictly true. He never heard his telephone *talk* until after he got his patent, and that fact demonstrates in the most striking manner the thoroughly scientific nature of the investigation, and the thoroughly scientific result which he reached. How? There is not one patent in a hundred, as your honour knows, in which the inventor has ever made his machine and tried it before making his application. He invents it; he sees with the eye of knowledge that it will work; he puts it on paper and takes a patent for it. If he is mistaken in his theory—if it will not work—he has not made the invention. If he is not mistaken, and it will work, he has made the invention; and the law does not require him to have first made it and put it into practical use, if he communicates to the public by his patent the description of his principle of action, which will, in the hands of skilled workmen, produce the proposed result. Some inventions are empirical—obtained by mere experiment. This was purely scientific. Prof. Bell saw with the eye of science that he had made a great discovery, and *knew* that it was certain. He tried some experiments and got some noise, and that convinced him of the capacity of the thing to transmit *sound*, which was the only doubtful thing he had to solve by trial. That it must necessarily transmit the *form* of the sound he knew as well before he heard it as ever he could know it. He was master of the subject."

New Telephonic Apparatus.—We believe that the instruments of Prof. Silvanus Thompson, which we have illustrated in our present issue, are claimed as being quite without the Bell-Edison patent rights, and that they are now the property of the New Telephone Company which has been formed for exploiting them.

In the House of Commons on Friday week, in answer to a question put by Mr. Kenny, Mr. Shaw-Lefevre said: No opportunity has been given to the officials of the Post Office up to the present time of examining the valve telephone of Prof. Thompson.

Apropos of this matter, our attention has been drawn to the following letter in the *Field*:—The attention of the new Telephone Company, Limited, having been drawn to the letter signed "C," in the *Field* of 18th ult., I desire to say that the want of which your correspondent complains is on the eve of being supplied, this company having been recently formed to supply the public, at a low rate, with an efficient telephone, invented and patented by Professor Silvanus P. Thompson. This telephone, for the manufacture of which this company is now entering into contract, will be sold to the public out-and-out, and not leased at an exorbitant rent or under arbitrary conditions. It will sell at a price within the means of all, and will base its calculations of profit on the number sold, and not merely on the price of each instrument. I hope this will be satisfactory to your correspondent "C," and those who, like him, desire to profit by an invention which is at the same time simple, useful, and by no means expensive in itself." We have no clue as to the identity of the writer.

Opposition to Electric Lighting, &c., in Bradford.—The Bradford Improvement Bill, which has been referred to a Special Committee of the House of Commons, will be opposed by the Board of Trade, where it seeks to make permanent electric lighting powers, and by the Postmaster-General as regards its provisions bearing on the erection of telegraph wires.

The Leeds Corporation and the Electric Light.—The electric lighting of the Leeds Municipal Buildings has been dispensed with for the present, in consequence of the litigation pending between the Corporation and the contractors for the light. But why dispense with the light in the interim?

The Post Office and Telephonic Facilities.—In the House of Commons last week, in the discussion which followed on the Chancellor of the Exchequer's budget speech, Mr. Firth said the Chancellor of Exchequer ought to consider the question of the Government taking on themselves that which they claimed to have, if they thought fit, the management of telephonic communication. It was due to the public that a great department like the Post Office should supply telephonic as well as telegraphic facility.

New Cable Vessel.—We learn that the Eastern Telegraph Company is negotiating with Messrs. Robert Napier and Sons, shipbuilders, Govan, for the construction of a new screw steamer, intended to take the place of the lost ss. *Magneta*. It is confidently expected that Messrs. Napier and Sons will secure the order for the new vessel.

The Telegraph Department.—The Chancellor of the Exchequer, in making his financial statement last week, said:—"The telegraph service produced in the years 1884–85, £1,760,000, or £40,000 less than the estimate, which was £1,800,000, and £15,000 more than last year." He estimates the cost of the telegraph service for the ensuing year at £1,840,000, or £109,000 more than last year's expenditure, which was £1,731,000. The yield he also estimates at £1,760,000, the same amount as last year.

Admiralty Telegraph Wires.—The dockyard authorities at Portsmouth have received an intimation to the effect that during the present state of public affairs the use of the Admiralty telegraph wires should be reserved for the more important necessities of the Fleet, and for other matters of really pressing importance.

Telegraphic Communication with the Isle of Man.—On Saturday, the 19th ult., telegraphic communication was resumed with the Isle of Man, after a week's interruption, by means of a new cable belonging to the Post Office, and laid by H.M. telegraph ship *Monarch*. It was necessary in the first place to pick up the old cable between Ramsey and St. Bees, in order to prevent the new cable from overlaying it. The old cable had been down since 1859, and had been frequently repaired. The cable for this purpose was manufactured by the India Rubber, Gutta Percha, and Telegraph Works Company, at their manufactory at Silvertown. The total length of cable laid was 31 knots. The cable consists of three conductors, insulated with gutta percha. The conductor consists of seven strands of copper wire, to the weight of 107 lbs. per knot, and the insulator of three coats of gutta percha, alternating with compound, to the extent of 150 lbs. per knot, so that each wire would weigh 257 lbs. per nautical mile. The three insulated conductors were served with Russian hemp yarn, and sheathed with ten galvanised iron wires of a diameter ·280 in. to a lay of $13\frac{1}{2}$ in. The sheathed cable was served externally with two layers of Russian hemp, gas tarred, with three servings of Clark and Preece's compound, making a total weight of about nine tons per knot. It has been found that *gas tar* acts as a greater preservative than ordinary tar, and is now used on all of the Post Office cables. The electrical properties of the cable are excellent. Immediately on completion of the cable telegraphic communication was resumed—*one* wire being devoted to direct communication between Manchester and Douglas, a second between Liverpool and Douglas, and the third left *spare*, ready to be brought into use in the height of the season, or at such times as the heavy traffic might require.—*Mechanical World.*

Cheap Telegrams.—*Blackwood's Magazine*, in its May number, contains a long article on cheap telegrams. It argues that the Government ought not to give way to the public clamour for a rate which would not be self-supporting. To do so would result in the taxation of the general ratepayer, for the purpose of benefiting the telegraphing public, or it would lead to further sums being sunk annually in the abyss in which the eleven millions originally paid for the telegraphs still remains.

Longitude Observations.—Monsieur Bouquet de la Grye, a French hydrographical engineer, has recently been busy making a series of astronomical observations for the purpose of determining the exact position of the town of St. Louis-Senegal. Time signals are transmitted direct from the Spanish Observatory at San Fernando to the station erected at St. Louis by means of the cables of the Spanish National Telegraph Company, which have been placed at the disposition of the French Government in this matter.

The "Lightning-Rod Man" Again!—On Sunday last, Paisley Church, Manchester, was struck by lightning, and, besides other mischief done, the lightning conductor was smashed. There is no doubt that the conductivity of the rod was much too low, or that the earth was bad. A correspondent of the *Manchester Examiner* hopes that the occurrence will be a lesson to those who persist in employing "fixers" of lightning conductors, who are absolutely ignorant of the means of carrying out such work.

The Dangers of Steam Trams.—We have already had (says the *Mechanical World*) quite a number of very serious and fatal accidents, and if the use of steam is to be retained it will be essential that the rules and regulations which have been laid down respecting the working of steam tramways should be rigidly enforced. An action for damages has been brought against the Manchester, Bury, Rochdale, and Oldham Steam Tramway Company by a carter named Slater, who was driving a lurry of castings on the evening of October 9th last, when a tramcar engine dashed into his lurry, smashing it, and throwing the plaintiff under the wheels of another lurry. The jury found a verdict for the plaintiff for the full amount claimed, £50. In a somewhat similar case tried in Dublin last week, a verdict for £300 damages was given against the Dublin and Lucan Steam Tramway Company. This action was brought by a plumber for the loss of his wife, who was killed whilst driving with her husband and family in a carriage, which was struck by the Company's engine, the driver of which was signalled to slacken.

Loss of the ss. "Magneta."—A contemporary says, the loss of the new telegraph ship *Magneta*, with, there is too much reason to fear, "all hands," has drawn attention to a probable cause of similar disasters. When a vessel like that is lost, and none of her crew are saved, there is reason to fear that some sudden and exceptional disaster has occurred, which left no time for getting out boats or for taking well-known means of at least leaving a record. There is a suspicion that one of her boilers exploded, and those familiar with the effects produced by a large body of highly-heated water suddenly relieved from constraint will readily understand that the vessel may have been broken in two and sank at once, taking every soul of her living freight with her. The suspicion is warranted by the fact that boilers constructed of the mild steel which is now generally employed do fail at times in the most unaccountable manner; and it is supported by the reflection that as the *Magneta* had two lifeboats, and the same number of cable repairing cutters, besides other boats, some, at least, of her crew would have escaped if she had foundered merely from the effects of a storm.

Hoist with his own Petard.—The aristocratic guest at a masked ball, recently given at Turin, who amused himself with practical joking at the expense of the ladies and gentlemen present, narrowly escaped paying a heavy price for the pastime in which he indulged. He attended the ball disguised as Rigoletto, the indispensable hump required to take this character being used to conceal an electrical apparatus, the wires leading to his hands and feet. Thus, when Rigoletto touched the hands of one person, or intentionally brought his foot into contact with that of someone else, he communicated electric shocks, which caused the ladies to utter little shrieks of alarm, and in the end created quite a panic amongst the company until the mystery was cleared up to the general amusement. Suddenly, however, Rigoletto began jumping about, gesticulating, and uttering cries of distress. It was at first believed that this was assumed to promote further laughter, but when the unfortunate gentleman had shouted repeatedly for help it dawned upon those who witnessed his antics that he was decidedly no longer joking, but that something serious was amiss. And such was the case, for he fell insensible to the ground; and on his hump being torn off it was found that the electric wires had become entangled, the consequence being that poor Rigoletto had received all the force of the electric current into his body.—*Standard.*

The Colonial War Preparations.—According to the *Times* Durban correspondent, it is hoped that the Imperial authorities will take steps to establish a temporary despatch service across the interrupted cable section. The Cape Town branch of the Africander Bond strongly urges the construction of a western deep-sea cable in preference to a land coast line carried through the territory of foreign Powers.

Telegraph Wires.—It is stated that the Western Union Telegraph Company (U. S.) exchange about 1,000 tons of old wire for new every year. The new wire costs from seven cents. to eight cents. per pound, and for the old about one-eighth of a cent. per pound is allowed.

Damage to Telegraph Plant.—At the Rothesay Sheriff Court, last week, a young man was fined two guineas for breaking telegraph insulators on the line between Corrie and Brodick (Arvan).

Severe Thunderstorm.—A thunderstorm, accompanied by heavy showers of rain, passed over Glasgow and the neighbourhood on Saturday evening. A church at Mossvale, Paisley, was struck by lightning and considerably damaged, while the windows in the houses adjoining were shattered.

The B. T. K. Accumulators.—The commissioners of the International Inventions Exhibition have adopted the B. T. K. accumulators in connection with the lighting of the subway, 80 of the No. 2 cells are being fitted, a portion of them having been working from the day of opening. The Consolidated Company's incandescence lamps of 20 C.P., 90 volts will be employed in lighting Spiers and Pond's temperance refreshment rooms at the exhibition.

Electrical Governors.—The Chicago correspondent of the New York *Electrical World* writes:—"The Amet electric governor for engines is fulfilling all the promises that have been made for it, and the Globe Electric Engineering Works are putting in machinery for its manufacture on quite a large scale. It has been submitted to competent experts and all kinds of tests, and has received the highest endorsements. Quite a number of the governors are already in practical use and giving satisfaction. At a recent test 23 out of 29 lights were thrown off, and the speed was automatically and promptly reduced from 315 to 107 revolutions. It is one of those simple inventions which often prove so valuable."

Proposed Electric Tramways on Ryde Pier.—On Saturday afternoon at a special meeting of the shareholders of the Ryde Pier Company the question of the desirability of utilising electricity for the working of the tramways on the pier was discussed at considerable length. The directors had entertained a proposal to work the tramways by means of electricity, but upon this becoming known a memorial signed by fourteen shareholders was forwarded to them requesting them not to adopt electricity until the question had been submitted to a meeting. In the course of the discussion it was stated that on a former occasion an agreement was entered into with Mr. Brain, an electrical engineer, for the carrying out of the scheme. However, the chairman (Mr. G. Garnett) stated, Mr. Brain failed owing to his attempting to work on the principle of secondary batteries, and because, moreover, he had never served an apprenticeship, and had never made himself cognisant of the leading natural principles which must be thoroughly understood before one could deal with such a potent power of nature as electricity. The directors so safeguarded the company that they were not involved to the amount of more than £20 when Mr. Brain "walked off." A resolution was moved by Mr. Gibbs, a director, to the effect "that this meeting is of opinion that the tram traffic on Ryde Pier can be best worked by electricity." Alderman Cudlipp, of Portsmouth, also a director, who seconded the resolution, bore testimony to the fact that electricity is the great mode of traction of the future, and remarked that although he had little faith in the storage of electricity by means of secondary batteries, owing to Mr. Brain's failure, he could see no possible chance of failure if they adopted Siemens's system, as they probably would. An amendment; "That it be recommended to the directors to adopt a system of wire rope as the traction-power for the Pier Tramway," was submitted by Mr. C. Colenutt, another director, who enlarged upon the uncertainty of the electric system, which was at present in its infancy, and urged that its adoption for the tramways would be a continual source of expense and trouble to them, whilst he ridiculed the idea that its novelty would attract many visitors to ride, when under other circumstances they would have walked. Mr. Gibbs said that the working expenses of the electric system for a year would amount to £280, and at the end of that time they would have the option of purchasing the apparatus for £600. On the amendment being put to the meeting it was carried by two; but on a poll by proxy being demanded, the resolution was carried by 2,131 to 813.

Millionaires Looking at Motors.—A distinguished party consisting of Jay Gould, Sidney Dillon, Russell Sage, President Samuel Sloan, of the Delaware, Lackawanna and Western Railway; Frederick F. Thompson, of the First National Bank; Henry V. Parsell, of the North River Bank; President Edward H. Johnson, of the Electrical Railway Company of the United States; Mr. Cyrus W. Field, Hon. David Dudley Field and Rev. Dr. Henry M. Field, visited Mr. Edison, at Bergmann and Co.'s, corner of Avenue B and 17th Street, this city, on the 16th inst., and inspected the electric motors intended for trial on the Second Avenue Elevated Road. They were greatly pleased with what they saw there, as well as with many ingenious electrical devices and conveniences which they saw afterwards at Mr. Johnson's residence.—*Electrical World.*

Hush thee, my Baby!—An American exchange is responsible for the following: A new telephone instrument has been invented by which the crying of a baby may be heard at the distance of a hundred miles. Of the fifty millions of people in this country there may be a dozen or two who yearn to hear the yells of a baby a hundred miles distant, but we doubt it. A contrivance that would prevent the crying of a baby being heard at a distance of ten feet is what the sleepless parents of this country demand.

An Interesting Relic.—According to the *Electrical World* the New Haven (Conn.) Colony Historical Society has just come into possession of a piece of the cord which was attached to the famous kite which Benjamin Franklin flew in 1750, and through which he brought the electricity from the clouds. It is apparently linen twist, through which passed a fine copper wire. Its authenticity is vouched for. It has been in possession of the donor for 50 years.

Electric Launches.—At the invitation of a foreign Government, Mr. Reckenzaun, who has done much for the application of storage-batteries to tramcar locomotion, has produced designs for a torpedo-service launch, to be propelled at high speed by electricity. The conditions enjoined are that this craft should make a voyage across the English Channel and back in moderately fair weather, and the construction of the vessel and machinery is to be commenced without delay. In view of important improvements in the electrical appliances her speed may be expected to exceed anything hitherto attempted, and we fully believe in Mr. Reckenzaun's ability to accomplish all that is required of him.

High Electromotive Forces.—We believe that machines for the Brush system of electric lighting have been constructed to give as high an E.M.F. as 3,000 volts. Can any of our readers inform us of any practically worked dynamos which have exceeded this? In M. Deprez's experiments on the transmission of power the electromotive force of the transmitting dynamo was considerably less than the figure above quoted, yet he found much difficulty in securing adequate insulation.

The Portrush-Giants' Causeway Tramline. — We understand that an extension of this electrically-worked line is under consideration, and that it forms the subject of a Parliamentary Bill. We hear that some opposition has been offered on the ground of danger from the electric currents, and that Sir William Thomson has already given evidence as to the immunity of the system from any liability to injure persons.

The Course of True Love, &c.—Many of our readers (Madeira *Monthly Correspondent*) will at once recognise the authorship of the following amusing lines, which were inspired by a discussion concerning our old friend the Recorder "Mill," and found amongst the rough notes of one of our fellows, after "electrical instruction," one morning:—

A magnet was slung below a Mouse mill,
Its duties as Motor to fulfil,
When charged with a current, 'twas always sure
To attract the guileless armature,
But though to enslave was his darling whim,
No armature ever kept faith with him,
For aye as he felt his passion burn,
The armature past him was sure to turn.
Was sure to turn? Was sure to turn!
So his erratic
Dynamo-Static
Fancy craved to learn
Why the heart of a charmer
In *soft*-iron armour
Away from his arms should turn.

For a long, long while, he was left to his sighs,
Till the following spectacle opened his eyes,
And to him discovered beyond all doubt
The dastardly rival who'd "cut him out,"
For a cam-wheel aloft with a heart of stone
Was acting the part of a chaperone,
And cold water threw on his luckless love
By some cruel manœuvring up above.
Ring up above? Ring up above!
So this pathetic
Passion magnetic
Can never be termed secure,
For a cam's interference
Will aye make a clearance
On the part of the armature!

GUPPY.

The Antwerp Exhibition.—The Universal Exhibition was opened at half-past two on the afternoon of the 2nd inst. by King Leopold, in presence of about seven thousand people. The President of the Exhibition delivered a long speech, alluding to the apprehension at first entertained that the carrying out of the undertaking might be beset with difficulties—fears which, thanks to the powerful patronage of the King and the co-operation of all the countries of the world, had been successfully dispelled, allowing the Exhibition to assume vast dimensions. In reply, King Leopold expressed his gratification at seeing the realisation of the great work.

A French contemporary takes occasion to remark that electricity does not in this Exhibition take the place which it ought to hold, and that the process of organisation goes on too slowly.

Electric Light for Scenic Effects.—Messrs. Boracchi and Corti, the lessees of the La Scala Theatre, Milan, have taken Her Majesty's Theatre, and intend representing, towards the end of the month, the Italian spectacular ballet of "Excelsior," by the Chevalier Manzotti, of Milan, with an entire Italian company. In the performance the electric light plays a prominent part for scenic effects; indeed, one of the scenes represents Volta's discovery of the voltaic battery. The ballet has been performed in various parts of the world with great success, and some of our friends who have witnessed it in Paris say it is the grandest spectacle they have yet seen. Mr. Shepherd, the founder of the Edison Italian Company, and who introduced the Brush system into Italy (the former making its *debut* at La Scala Theatre), and who placed the first installations of that system in the industrial establishments, is now in this country for the purpose of studying the Inventions Exhibition for the latest improvements in connection with electric lighting, and has been charged by Messrs. Boracchi and Corti to superintend the electric light arrangements. Mr. Shepherd is intimately acquainted with the arrangements of these matters in Italy, and it is his intention to introduce as many decided improvements as possible into the principal theatres upon his return.

Loss of Energy on Electrical Tramways.—It does not appear to be generally known how much electrical energy is wasted on tramways in which the separate conductor system is employed. Take, for example, the Portrush-Giant's Causeway line; the initial E.M.F. is 250 volts, and the current 100 ampères, equivalent to about 34 horse-power. The conductor resistance is about two ohms, therefore when the cars are at the extreme end of the line no less than 27-horse power is wasted in heating the conductor. Luckily the motive power is obtained from a waterfall, or this waste would be a serious drawback from an economical point of view.

The Prince's Theatre.—We recently visited the installation of electric lighting at this theatre, full particulars of which were given in the REVIEW for April 11th. It appears to work most satisfactorily, and to involve but little trouble upon those in charge.

Telegraph Companies in Trouble.—Basing its remarks on information derived from the *Jornal do Commercio* of Rio de Janeiro, the *Financial News* has recently published much that is interesting respecting the Brazilian Submarine and the Western and Brazilian Telegraph Companies. Our *Financial* contemporary commenced as follows:—"The two principal English telegraphic companies doing business in Brazil seem to be in a sea of trouble. These companies are the Brazilian Submarine and the Western and Brazilian, the latter enjoying the concession for a cable along the coast of the Empire, and the Submarine joining Pernambuco to the European continent. According to the terms of the concession to what has now become the Submarine Company, dated August 16th, 1872, the terminal station of this company in Pernambuco should deliver to the Government central station in that city its messages for transmission to other parts of the country. Clause VI. says very clearly that 'all telegrams for Brazil shall be handed over to the telegraph employés of the Empire by the employés of the concessionaire.' The reason of this injunction in the concession is self-evident. Brazil, having a territory nearly as large as that of the United States, including Alaska, would naturally try to get as much work as possible for its telegraphic system, which has been very costly and has very little to do. Later on, however, it seems that the Submarine Company made a working arrangement with the Western and Brazilian, which became the owner of a very bad concession, granted in 1870, but renewed and otherwise modified in April, 1872, and April, 1873. The Director of Telegraphs complained that the two companies, while enjoying the protection of the Government, had joined in an unlawful combination to defraud its revenue. The matter was thought important enough to be submitted to the Council of State, and the Emperor, approving of their opinion, has given his decision, which is published in the Rio de Janeiro papers of the 4th ultimo. It is declared that the two companies have been eluding some of the stipulations in virtue of which they enjoy their concessions, their proceeding being aggravated by the fact that they did not notify the Government of any such agreement having been entered into between themselves for the distribution of their business, a circumstance which was not lawful in itself, in view of the fact that both companies are subjects of the Government according to the concessions. The two companies are then warned that any agreement is null and void which draws telegrams away from the land lines, and, should it be persisted in, the concessions may be declared as null and void, and steps will be taken to compel the companies judicially to indemnify the State for the damages thus caused by them."

NEW COMPANY REGISTERED.

Universal Contract Corporation, Limited.—Capital £300,000, divided into 2,987 ordinary shares of £100 each, and 13 founders' shares of £100 each. Objects ; To construct, maintain, and work telegraphs, electric works, or works for the supply, use, or application of electricity, or electric light and power, railway, tramway, water and gas works, and generally to trade as contractors for public works, builders and engineers. To purchase a business carried on under the style of Harrison Ainsworth and Co. Signatories (with one share each) : E. A. Harrison Ainsworth, 28, Martin's Lane, E.C. ; H. P. Bernard, 107, Cannon Street ; C. E. H. Audain, C.E., 25, Lancaster Road, Westbourne Park ; S. Wilkins, 12a, York Grove, Peckham, surveyor ; R. T. Linford, 31, Westmoreland Street, Pimlico ; E. C. Davies, St. Gabriel's, Dulwich ; W. Whieldon, 46, Devonshire Chambers, Bishopsgate Street. Directing qualification, £250 in shares or stock ; the signatories are to appoint the first directors, and act *ad interim.* Remuneration, £200 per annum to each director. Registered 5th inst., by Mr. E. H. A., 27, King Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Telephone Company of Egypt, Limited.—The annual return of this company, made up to the 2nd inst., was filed on the 4th inst. The nominal capital is £100,000, divided into 16,000 preferred and 4,000 deferred shares of £5 each. 16,071 shares have been taken up and the full amount has been called thereon, the calls paid amounting to £80,355. Registered office, 14, Austin Friars.

Iron Primary Battery Company, Limited.—The first return of this company, made up to the 9th March, was filed on the 16th March. The nominal capital is £200,000 in £5 shares. 1,000 shares are taken up and a call of £5 has been made, but at the time of filing no amount had been paid thereon. Registered office, 21, City Road.

Elwell-Parker, Limited.—The first return of this company, made up to the 8th ult., was filed on the 15th ult. The nominal capital is £50,000 in £10 shares. 16,000 shares have been taken up. Upon 850 shares £10 has been called, and upon 750 shares £8 has been called ; the total calls paid amounting to £14,500. Registered office, Commercial Road Works, Commercial Road, Wolverhampton.

CITY NOTES, REPORTS, MEETINGS, &c.

The Brazilian Submarine Telegraph Company, Limited.

THE 23rd ordinary general meeting of the proprietors of this company was held at Cannon Street Hotel on Thursday, the Right Hon. Viscount Monck, chairman of the company, presiding.

The Secretary, Mr. Richard Collett, having read the notice convening the meeting,

The Chairman said : Gentlemen, I presume you will take the report as read, as usual. This having been agreed to the Chairman continued : It is now my duty to move, as this is only a half yearly meeting, the only resolution that will be submitted to you to-day, namely, "That the report and accounts of the directors to the 31st December, 1884, now submitted, be approved and adopted." Gentlemen, I noticed in the report in the public papers, at the annual festival gathering, that takes place at the beginning of the Royal Academy Exhibition, that several of the speakers bewailed their condition, in that they were called upon every year to speak on the same subject, and found it very difficult to produce new matter for the entertainment of the company. I feel myself in a similar position. I appear before you every six months to give an account of the transactions of the company. Those transactions are generally of a somewhat monotonous, though not altogether of an uninteresting character, and generally set forth the doings of a prosperous undertaking. However, gentlemen, too, when the facts of the case do not supply me with straw to assist in the manufacturing of my oratorical bricks, I only confess that I find it difficult to make chaff take its place. But I will say a few words to you on the accounts which have been laid before you. Now, gentlemen, with regard to our revenue, I have often said before, that it is not fair, and would not be right to compare two succeeding years, because it is notorious that the fluctuations in trade upon which our revenue depends causes a much larger income to be received in one half than in another. That is to say, the flow of trade from Brazil to Europe at one period of the year is larger than it is at the other. And therefore a comparison of two successive half years might lead to very misleading and fallacious inferences. There is another consideration, namely, the breakdown of our cable in the year 1883, which caused a breach in our receipts which would render a comparison with last year quite impossible and absurd. I therefore compare the half year ending 31st December last with the half year ending 31st December, 1882, and I find that the income for the corresponding half year of 1884 was £817 larger than the income for 1882. Well, this is not a large sum, but still it is an increase ; and taken in connection with the fact that there was in the meantime a reduction of tariff, which shows that we need fear nothing with regard to the increase of our trade. Well, gentlemen, so much for the income. The expenditure stands on a different footing—in reference to comparing two successive half years from the revenue—because there is nothing in the circumstances or the case which ought necessarily to make any distinction or difference between the amount of expenditure in one half year, and that of the other. We may fairly compare two successive half years with reference to expenditure, and I find that, taking the two half years 1882 and 1884, the net expenditure in each half year is £12,108 to June, 1884, and to December, 1884, £12,351. Now these figures are arrived at by eliminating from the accounts of both occasions the *extraordinary* expenses. In the last half year the gross expenses came to £21,851, but in that we include the expense of issuing debentures (which was an extraordinary expense), £360 ; repairs to spare cable at Pernambuco, £245 ; and repairs to Madeira and St. Vincent cable, £8,737 ; and defalcations by a clerk at Pernambuco, £156. Deducting these expenses and the sum of £700 which was spent in the repair of the cables in the previous half year, the net expenditure shows an increase in the December half year of £242, and that increase is composed of a payment of £72 for patents. And I may here explain that the reason of the fluctuation in that item is that we only pay for the patents when we use them, and our cable being down in a portion of 1884, the payment on account of the patent was less than in the previous year. The other increases were a small increase of salaries, &c., in London, £52; and at the stations of £124. As the company grows in years, and its *employés* become old servants, we must improve their condition, in order to retain good men. And also as our traffic increases, we must increase the number of our staff. These considerations account for the increase which has taken place. It has taken place against the wish and desire of your directors, whose sole object is to make the expenses as small as possible consistently with the efficient working of the company's business. If you look at the accounts you will see that at the time the report was printed, there was a sum of £30,000 still due to the Telegraph Construction Company for a new cable. This has, however, been paid since the report was issued, and all is now your property; with the exception of the debenture stock. Your property is in a good condition; we are working well, our revenue shows a slight increase, and I trust that nothing will prevent us from meeting you with a cheerful face, as hitherto, and paying you the dividend that we have hitherto given to you.

Sir James Anderson (one of the directors), in seconding the adoption of the report, said, with reference to what the chairman had said as to the growth of the traffic being very small, he had yesterday realised another reason for it. In the Eastern Company they were carrying 100,000 more messages, and no more words, in a year than formerly, for no more money; and in the Direct Spanish Company they were carrying three messages for the same money as they used to get for two; this was owing to the method of codification insisted upon by the merchants, though he believed that many of the codes were illegal. Even whilst they were struggling against that method of economy on the part of the merchants, they were making *some* headway.

The Chairman: I am much obliged to Sir James Anderson for making the observation he has made, which his practical experience enables him to do, but which I was unable to do.

The proceedings then closed with a vote of thanks to the Chairman.

London Platino-Brazilian Telegraph Company.

THE directors of the London Platino-Brazilian Telegraph Company, Limited, report that the net revenue of the past financial year, after providing for debenture interest and income tax, is £5,943, and £1,005 is brought from the preceding year's account, making a total of £6,948 to the credit of the revenue account. The interim dividend of 1s. 3d. per share absorbed £2,397, leaving to be dealt with £4,552, from which the directors propose to appropriate £150 in reduction of the item of expenses of issue of the 6 per cent. debentures, and £3,355 in payment of a final dividend of 1s. 9d. per share, being with the interim dividend at the rate of 1½ per cent. per annum, carrying forward a balance of £1,046 1s. 8d. The directors report an increase of traffic over the land lines in Uruguay, the net revenue from this source being £625 more than in the precious year. This increase, however, is more than counterbalanced by the serious decline in the amount received from the Western and Brazilian Company, the amount credited to this company by that company being £10,655 against £12,638 in 1884. The difference between the directors of this company and the Western and Brazilian Company with respect to this company's proportion of the receipts for telegrams, referred to in the last report issued by the board, has not yet been disposed of; meanwhile the amount involved has been kept out of the accounts. The board congratulates the shareholders on the payment of the arrears of the Government debt by the Uruguayan Government. As this debt, however, was paid in bonds at par, their realisation necessarily entailed a loss; but, having regard to all circumstances, the directors are glad that payment has been effected.

Submarine Cables Trust.

THE report of the trustees of the Submarine Cables Trust to the 14th ordinary annual meeting of the certificate holders, to be held at the offices of the Trust, No. 66, Old Broad Street, London, on the 12th inst., gives the accounts for the financial year to April 15th, 1885. The revenue for this period, including the balance brought from the previous accounts, viz., £3,943 9s. 5d., amounted to £24,449 3s. 6d. Since the last report was issued the trustees have purchased nine certificates at a cost of £886, thus reducing the number of outstanding certificates to 3,381, and the capital of the trust to £338,100. The expenses of the trust for the twelve months amounted to £1,324 6s. 10d. The payment of two half-yearly coupons at the rate of 6 per cent. per annum absorbed the sum of £20,289, leaving a balance of £1,949 16s. 8d. to be carried forward. The dividend and bonus on the Eastern Extension Company's shares (£2,987 11s.) recently announced, but not payable until April 29th, will be included in the revenue for the current financial year. The securities held by the trustees remain unchanged.

Telegraph Construction and Maintenance Second Bonus Trust.—Coupon No. 20 on the certificate issued under the trust deed of the 12th March, 1875, at the rate of 1s. per £5 certificate (nominal value) is payable at the office of Messrs. Barclay, Bevan & Co., 54, Lombard Street, E,C. Further supplementary sheets, containing six coupons (numbered from 19 to 24), may be obtained by certificate-holders upon production of their certificates at the offices of the company, 38, Old Broad Street, E.C.

The Eastern Extension, Australasia, and China Telegraph Company, Limited.—This company announces the numbers of 239 Five per Cent. Australian Government Subsidy Debentures of £100 each which have been drawn for payment at par on July 1st by Messrs. Barclay, Bevan & Co.

Great Northern Telegraph.—The excess dividend on the shares for the year 1884 will be paid at the rate of 6s. per share on presentation of Coupon No. 3 at the office of Messrs. C. I. Hambro & Son, 70, Old Broad Street, E.C.

Anglo-American Brush Corporation.—We are informed that the Right Hon. Lord Sudeley has joined the board of this corporation.

LEGAL.

Dawson v. The Phœnix Electric Light Company, Limited.—Before Mr. Justice Chitty.—This was an action by a holder of 500 shares in the above company, which since the action had gone into liquidation, to set aside his contract to take the shares and to recover £250 paid on allotment thereof, and to make the company's directors jointly and severally liable in respect of the plaintiff's claim. The ground of the action was misrepresentation in the prospectus issued by the company.

Mr. Justice Chitty said that the plaintiff, to be successful against the company, must establish that the representations complained of in the prospectus were made by the authority of the company on matters material to the contract; that they were, in fact, false; and that the plaintiff contracted on the faith of the representations being true. To be successful against the directors he must show knowledge on their part of the falsity of the representations or reckless disregard of their being true or false. In his lordship's opinion the plaintiff had failed in making out any misrepresentation on the face of the prospectus which could support an action except in the case of one statement. That was that an offer had been received to purchase the right to use the company's patents in Scotland for £40,000 and further proposals to the extent of £145,000 for other districts had been submitted. The facts were that three offers had been made—the £145,000 offer was from a firm renting offices at £75 a year; the £40,000 offer came from persons giving an address in the neighbourhood of the Bank of England. These persons had offices at a rent of £12 12s. a year—or rather a garret at the top of a house in Walbrook which was in the occupation of a printer, who had let them the use of the room when he himself was away from it, and on condition that they should turn out when he came back for his meals. This City firm, addressing from the known centre of wealth, was no longer to be found, having vanished in debt to their landlord for rent and also for printing. The third offer was from a man who stated that he was authorised by influential friends to make offers for concessions. This man was discovered to have been more than once bankrupt, to be still an undischarged bankrupt, and to have had during the space of a very few years no less than two dozen unsatisfied judgment debts recorded against him. None of the offers resulted in anything. The plaintiff was no doubt induced to take the shares on the faith that the offers which had been made were good offers. He was misled by the prospectus, and, therefore, as against the company, was entitled to succeed in his action. His position with reference to the directors was different. They were undoubtedly honest men. There was no ground for saying that they had acted recklessly. The evidence showed that they had made inquiries and were satisfied that the offers proceeded from persons capable of carrying into effect their offers. The result was that, although succeeding as against the company, the plaintiff failed as against the directors, and as against them his action would be dismissed with costs. There would, therefore, be a declaration for the rescission of the contract to take the shares, and the plaintiff would be entitled to prove in the liquidation for the £250 and interest thereon at 5 per cent.

TRAFFIC RECEIPTS.

The Cuba Submarine Telegraph Company, Limited. The number of messages passing over the lines of this company during the month of April was 4,320, estimated to produce £3,700, against 3,801 messages, producing £3,401 in the corresponding month of last year. The receipts for the month of January, estimated at £3,000, realised £3,013.

The Western and Brazilian Telegraph Company, Limited. The receipts for the week ending May 1st were £2,547, after deducting the fifth of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.

The West India and Panama Telegraph Company, Limited. The estimated receipts for the half-month ended the 30th April, are £3,810, as compared with £3,126 in the corresponding period of 1884.

The Great Northern Telegraph Company. The receipts for April, 1885, £24,800; from January 1st to April 30th, 1885, £89,200; for the corresponding months of 1884, £81,640; and of 1883, £77,920.

The Direct Spanish Telegraph Company, Limited. The estimated receipts for the month of April were £1,510, against £1,811 in the corresponding period of last year.

The Brazilian Submarine Telegraph Company, Limited. The receipts for the week ended 1st May amounted to £3,172.

PROCEEDINGS OF SOCIETIES.

The Society of Telegraph-Engineers and Electricians.

(*Continued from page* 409.)

Prof. CAREY FOSTER agreed with Prof. Perry that the question was one very largely of definition. Taking the case of a Daniell cell consisting of copper, sulphate of copper, sulphate of zinc and zinc, he did not think Dr. Lodge made it clear whether the difference of potential is between the copper and the sulphate of copper, and on the other hand between the zinc and the sulphate of zinc. Now that question is very closely connected with that of whether, in the case of electrolysing sulphate of copper with two copper terminals there is a large difference of potential between copper and sulphate of copper at each end, or whether there is not. He thought we had sufficient experimental knowledge to settle that question off-hand, and it is closely connected with the observations which are familiar to everyone, that if you are electrolysing sulphate of copper where copper is deposited, you get an impoverishment of the solution, whereas at the other terminal, where the copper is being dissolved, you get a concentration. From that it follows, he thought, beyond all doubt, that the difference of potential is considerable between the solution and the metal, and is small between the sulphate of zinc and the sulphate of copper.

Dr. FLEMING thought that if anything could possibly add to the great value of the *resumé* on the subject, it would be if Dr. Lodge could have given the result of any crucial experiments tending to clear up points in dispute which still remain to settle. To try experiments in anything which is commonly called a vacuum is perfectly useless. It appeared to him that a needful direction for experiment would be to take pieces of zinc and copper and to place them in a tube and endeavour to reduce any film of oxide on the surface, and get rid of the air, and then to surround them with some liquid, such as paraffin, and then try an expement.

Prof. FORBES stated that he was perfectly convinced that there was no possibility of arriving at any result whatever on the main point raised in this paper. Dr. Lodge has not given a single experiment to support his convictions, and therefore it resolves itself into a question of which theory it is the most convenient to use.

Prof. AYRTON: With reference to measuring what may be called the Peltier difference of potential at different temperatures, my colleague, Prof. Perry and myself, carried out a rather elaborate investigation (which has not up to the present time been published, and which we carried out in Japan in 1878), to attain this very result. We took two vessels of mercury and measured the contact difference, and so arranged matters that nothing but mercury was in contact with mercury, and we obtained very interesting and quite regular curves. These experiments would seem to show the immense difficulty of accepting any experiments like those made by Mr. Brown, where gases were employed which we know would produce films of oxide and sulphides on the surfaces of the metals. Here are results produced probably by perfectly inconceivable films of oxide, those films arising merely from the warm mercury oxidising more quickly than cold mercury. Experiments were also made of getting two plates of metal—not mercury—such as copper, and heating one relatively to the other, and measuring the Peltier difference of potential. The main value I attach to these experiments is as showing how very difficult it would be to accept any results which would appear to disprove the Peltier theory, obtained by replacing air by gas, which was known to have more vivid chemical action with one or other of the metals that was employed. I do not think it has been put quite rightly in saying that either Dr. Lodge's view or Prof. Perry's view may be taken; and that is what Dr. Lodge meant—that it was a mere question of convenience. I do not think this is what he intended. He meant that the contact theory, as given by Peltier and by Sir William Thomson, was wrong—nothing more or less than that it was wrong and could not be accepted, and that the other theory was probably right; that is to say, he considers that he has proved that there is not a difference of potential—there cannot be a difference of potential between zinc and copper in contact, for reasons given in the paper. Now there I totally disagree with Dr. Lodge. I say he has brought forward in this paper absolutely no argument to show that Thomson's original view or Peltier's original view, as employed by Thomson, was in any way wrong whatever, and also he has adduced absolutely no argument to show that gas has anything whatever to do with it. No experiments have yet been made to show that you will alter the case—alter the fact. Sir William Thomson has made experiments, and Brown has made experiments; and the latter got changes which were due to alternation of surface. The same explanation applies there as applies to the results obtained over and over again, because heat is not produced when electricity passes from copper to zinc or from zinc to copper, therefore there cannot be a difference of potential. I would go still further than my colleague, and say that he has given us no proof that there is not really a difference of potential between zinc and copper; not merely a difference of potential in the two points of the dielectric. Of course, if you say whenever there is a difference of potential between two metals whatever—that must be if you say there must be heat generated—then as there is no heat generated, there cannot be a difference of potential. We have no proof, no reason for saying that when two metals are in contact they cannot be at different potentials, and yet electricity in passing from one to the other shall produce no alteration in temperature, no heat or cold. In fact, it is quite possible there are two distinct forms of electric energy, one of which is the ordinary potential energy which the electrometer takes note of, and there may be another form of energy due to electricity residing in one or other of the two metals, an energy arising from the electricity residing in zinc as distinct from that residing in copper. It may be possible, we all know. We have no proof absolutely to the contrary, and it is quite possible that, leaving on one side the idea that if you take one end of the wire you get one effect, and if you reverse it you get a different effect, it is quite possible the zinc and copper are really at different potentials; but there is no question of heat or cold when electricity passes from one to the other, because one form of energy is given up and another form is acquired.

Prof. SILVANUS THOMPSON: The experiments to support the contact theory are all of them open to the very same objection as that taken to the experiments of Mr. Brown, which were made with other gases than air. Mr. Brown took the same metals, zinc and copper, placed them in a different gas, found the difference of potential to point the other way, that the copper was electro-positive and the zinc electro-negative, and until we have an experiment made in a medium that shall have no effect either on the zinc or on the copper, I should refuse to believe that any experiments can be adduced at all in support of any theory whatever.

Mr. SWINBURNE and Mr. OLIVER HEAVISIDE contributed written communications to the discussion.

Prof. LODGE having replied, the meeting adjourned till the 14th May.

NEW PATENTS—1885.

5282. "Switch for incandescent electrical lamps." A. SWAN. Dated April 29.

5293. "Indicator for electric bells." J. D. ADAMS. Dated April 29. (*Complete.*)

5298. "Method of employing induction coils for telephonic and other purposes." S. WILLIAMS. Dated April 29.

5314. "Regulation of electrical circuits and apparatus relating thereto." Sir D. L. SALOMONS. Dated April 29.

5341. "Construction of galvanic cells." C. D. RICHARDSON. Dated April 30.

5347. "Electrical relays." G. FORBES. Dated April 30.

5349. "Manufacture of tanks and cells for electrical purposes." D. A. DAVIS. Dated April 30.

5376. "Electric motors for the propulsion of boats and other purposes." A. RECKENZAUN. Dated May 1.

5379. "Operating electric railway trains or vehicles." T. J. HANDFORD. (Communicated by F. J. Sprague.) Dated May 1.

5387. "Switches for electric lamps." H. J. HADDAN. (Communicated by Schumann and Koeppe.) Dated May 1.

5393. "Instruments for testing and measuring electric currents." J. H. DAVIS. Dated May 1.

5400. "Electrical incandescent lamps." O. E. WOODHOUSE, F. L. RAWSON. Dated May 1.

5404. "Electrical train signalling apparatus." A. M. CLARK. (Communicated by E. J. J. de Baillehache.) Dated May 1.

5420. "Combined electric bell push and incandescent lamp holder and switch." C. K. FALKENSTEIN. Dated May 2.

5422. "Apparatus for insulating wires or conductors for electrical purposes." J. LUCAS, P. LAWRENCE. Dated May 2.

5463. "Increasing life and efficiency of electrical incandescent lamps." R. P. FUGE. Dated May 4.

5494. "Dynamo machines and electro-motors." C. A. A. CAPITO, M. P. HARDT. Dated May 4.

5546. "Recording telegraphs, partly applicable to other apparatus." G. G. N. HAGBORG. (Communicated by O. A. Ericsson.) Dated May 5.

5547. "Telegraph cables, chains or conductors for submarine and other purposes, and means for connecting such cables, chains or conductors together and to movable objects." R. M. LOWNE. Dated May 5.

5551. "Regulating electric arc lamps." M. H. HURRELL. Dated May 5.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1884.

3560. "Improvements in the transmission of electric currents by submarine cables." F. BOSSHARDT. (Communicated from abroad by Messieurs Hermitte and Payroulou, of Algiers.) Dated February 19. 6d. Relates to improved means for automatically transmitting electric currents by submarine cables, applicable to the recording apparatus, system "Thomson," and has for its object to bring the electric currents alternately into contact with the cable, by means of the application and combination with the signal system "Morse." To this end a band suitably perforated, representing the signals of the system "Morse" is engaged between and drawn by two rollers, actuated by clockwork, at a uniform speed. A play of two needles being employed and caused to move up and down and engage with perforations on the right and left side of the band, by means of a spiral spring, which needles, when engaged with the perforations, will produce an audible, mechanical, repeating of the same. When the band is in motion, and the needles meet the perforations, the needles will spring from one edge of the band to the other, and cause thereby a raising of a lever, until the latter comes into contact with the top part of the same, which closes the current of a local battery.

3668. "Method of giving an individual call to any one of a group of subscribers connected to a telephone exchange by one wire, and in the means employed therefor." J. STEPHEN. Dated February 21. 6d. Relates to an apparatus on the well known pendulum principle, the pendulum at each office having a different length.

3571. "Improvements in dynamo-electric machines." J. H. GREENHILL. Dated February 19. 6d. The inventor employs a species of "spoke" or wheel armature, built up of thin sheets of iron, which, for the purpose of ventilation and prevention of what are termed Foucault currents, have small air spaces between some or all of the iron sheets or portions of them, or they may be otherwise insulated in part or in whole.

3881. "Improvements in apparatus for registering a ship's course by electricity, applicable also to sensitive scientific instruments." J. H. BARRY. Dated February 25. 6d. The inventor suspends from the compass card two arms or bars of metal from any point of the card to its opposite point, and to which he attaches at both ends thin platinum or other wires working loose from hooks or eyes at the ends, the bars to which these are attached as well as those pendants are thoroughly insulated so as not to influence the action of the magnetic needle; this attachment travels with the card, or rather at every movement of the ship's head the compass card brings the pendants in connection with the poles of a battery, thus forming a contact, the pendants being the switch, and this occurring at every quarter point of the compass, registers the movements of the ship on a drum or roller worked by clock work or by the battery direct, on which drum is wound a roll of paper with the compass and the time of the day thereon, the wires from the battery being led to the compass and also to this clockwork, the said clockwork may be actuated by springs, and kept constantly revolving; an ink pencil is now attached to the movements from the card, and is operated along the surface as the ship's head turns, thus marking the course steered on the surface of the paper—this machine may be quite separate from the binnacle and placed on the bridge house or commander's cabin.

3885. "Improvements in electric arc lamps." W. GEIPEL, Dated February 25. 6d. The inventor employs two friction rollers to hold the upper carbon or carbon rod, one of these preferably larger than the other one, the large roller is geared with a brake controlled train of wheels in a frame resting on pivots or feet at the end distant from large roller, but free to move up and down at the end containing the large roller, and the other, a smaller roller, may be either tightly pressed against the carbon or carbon rod by means of a spring, or preferably, in order that the carbon or carbon rod be perfectly free from train of wheels when the lamp is not in action, the smaller roller may be fixed in an arm of a bell crank, and does not grip the carbon or carbon rod till the other arm of the bell crank is actuated by the keeper of a magnet or core of a solenoid. When the lamp is switched into circuit the bell crank is canted by the attraction of the magnet or solenoid, and the small roller brought up to the carbon rod or carbon, thus gripping it between the two rollers; a further movement of the keeper or core effects the lifting of the upper carbon or rod in the framework on the above mentioned pivots or feet. When the arc becomes too long the brake is raised by the regulating solenoid, the rollers are then free to revolve and the carbon is fed down by the force of gravity.

4327. "An improved means of transmitting sound by means of electricity, and of reproducing the same at a distant station." F. VILLIERS-STEAD and E. R. HEDGMAN. Dated March 4. 6d. The said invention consists of two parts, namely (1), a direct acting multiple plate transmitter, and (2) of the magnetic arrangements suitable for use in a receiver. The transmitter consists of a series of flat plates of carbon of suitable width and thickness, supported by means of projecting shoulders resting loosely in two upright pillars or blocks of carbon supported in or on a non-conductive frame or stand being in circuit with a battery and primary wire of an induction coil in the usual manner. The plates have one broad or two or more narrow shoulders at each end by which they rest loosely in holes or grooves in the pillars, or are connected with the pillars by pins or projections of carbon affixed to or cut out of the pillars and inserted into or bearing the plates. The plates are attached in such a way that the adjacent edges shall not be in contact with each other, but must overlap by having their edges bevelled off on opposite sides, as in fig. 1, or they may be arranged in an imbricated manner, that is to say, as the lathes of a Venetian blind. The magnetic arrangement suitable for use in a receiver consists of a soft iron armature, fig. 2, surrounded by insulated copper wire wound on a bobbin, which by preference, is made of soft iron, but may be of any other suitable material, and which is inserted between and very close to the opposite poles of a permanent magnet (in the manner shown in the figure) having soft iron pole pieces, B. The permanent magnet may be replaced by an electro magnet, in which case soft iron pole pieces are not necessary.

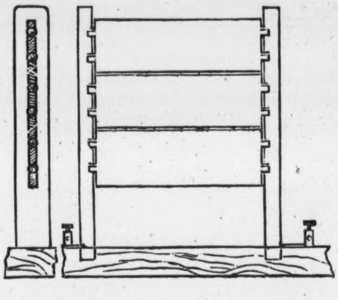


FIG. 1.

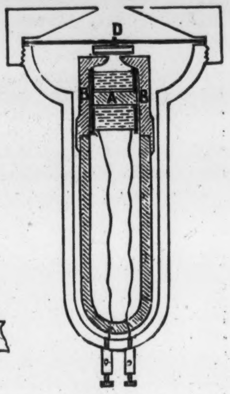


FIG. 2.

4781. "Improvements in carbon filaments for incandescent electric lamps." F. H. VARLEY, W. BEALE, and R. H. PADBURY. Dated March 12. 4d. Relates to improvements in incandescent lamps, whereby a larger luminous area of light is obtained. This the inventors effect by subjecting fine woven fabric, preferably made of a vegetable fibre, or silk to the treatment, as described in Letters Patents granted to F. H. Varley, numbered 2776 and 5055, A.D. 1882. Previous to submitting the fibrous material to the carbonising process, it is subjected to treatment in borax and alum.

4789. "Improvements in galvanometers." A. P. CHATTOCK. Dated March 12. 6d. In a galvanometer, according to the invention, the coil is suspended as well as the needle, and the tendency it experiences to turn is measured by a spring, which is made to oppose this tendency, keeping the coil at the zero point. The angle through which the spring is turned measures the product of the strength of current, and the strength of the magnetic field, thus the ratio and the product of the strength of current and of field being measured at the same time the value of the current is obtainable.

4937. "Improvements in incandescent lamps." J. S. FAIRFAX. Dated March 15. 6d. By this invention the glass envelope is made of a parallel tube, or one approximating thereto; thus dispensing with the blowing now required in the ordinary form of lamp. This tube may be plain or ornamental, straight or curved, as desired.

5026. "Improvements in electric arc lamps." C. D. ABEL. (Communicated from abroad by T. Basilevsky, of Russia.) Dated March 17. 6d. Has for its object to simplify the construction of electric arc lamps, and to produce a more constant light therefrom.

5245. "Improvements in electroplating chromium alloys." T. SLATER. Dated March 21. 4d. In order to produce upon articles electro-plated with chromium alloys a surface of plating of a bright golden colour, the inventor submits those chromium alloy plated articles to a bath of the following components, namely:—Chloride of tin, 6 to 8 parts; chloride of copper, 20 to 25 parts; bichromate of ammonia, 10 to 15 parts; chloride of platinum, 6 to 12 parts; cyanide of potassium, 25 to 30 parts; water, 101 to 110 parts; with the aid of an electric current of moderate intensity or force.

5309. "A new or improved combined holder and gallery for incandescent electric lamps." W. HARVIE. Dated March 22. 6d. Consists of a tubular stem, into the lower part of which the glass stem of the bulb of the lamp is fixed by plaster of Paris, or other suitable material. A portion of this part of the stem may be formed with slits in its sides, which may yield slightly in the event of the glass stem becoming heated by the incandescence of the carbon filament, and the plaster fills up a portion of the stem above the glass, excepting the upper part, wherein a disc of wood or other insulating material is placed, and to which the conductor-attachments leading to the terminals of the lamp are fastened by screws or otherwise. To prevent short-circuiting of the conductors or the terminals of the lamp, these are separated by a cross piece of wood, or other insulating material, either attached to or formed in one piece with the aforesaid disc. To connect the lamp to a pendant, or other form of electrolier, a metallic collar is used, which rests upon the cross piece of insulating material, and it is formed with a screw thread for attaching it to the pipe of such pendant or electrolier. By virtue of the position and length of the cross-piece of insulating material, it with the aforesaid metallic collar forms a steady connection with the pendant or electrolier, whilst a cap or covering joint piece covers over the coupling, insulating material, and terminal connections by being screwed over them, on to the aforesaid stem. This cap also attaches the gallery to the stem by holding the gallery between its screwed end and a flange left on the stem for that purpose. The conductors or leads, which are of covered wire, are led within the pipe of the pendant or electrolier to the source of electric energy.

5409. "Improvements in secondary batteries." G. PRESCOTT, M. F. PURCELL, D. SHERLOCK and W. H. DUNNE. Dated March 25. 6d. Has regard to an improvement in the mode of manufacturing the plates or electrodes, whereby the lead and its oxides, and the lead and its suboxides are more thoroughly mixed and a greater battery capacity can be obtained in a smaller space than was possible until now. This is effected by melting the lead and mixing therein in the most perfect manner the oxides and suboxides, and to such an extent as to produce a mass having the smallest resistance possible consistent with the proper action requisite.

5670. "An improved arrangement of circuit connections for electric lighting." H. EDMUNDS. Dated March 29. 6d. The inventor fits to the wall or other surface one or more sockets adapted to receive detachable electric lamps, and he provides a permanent lamp in the centre of the ceiling or elsewhere which he calls a pilot lamp. Interposed in the circuit leading to this pilot light is a switch controlled by an electro-magnet, which magnet is arranged and wound so as to be excited by the current or currents passing to the terminals in the sockets above referred to. When it is desired to illuminate the apartment at any particular place or places, one or more of the detachable lamps are connected with the terminal plates or wires of the fixed sockets, the current passes, and one or more lights are obtained. So soon, however, as this is done, the electro-magnet is excited, and operates the switch or bridge piece by which the current had passed to the pilot lamp, automatically cutting that lamp out of the circuit and economising the current. On detaching the local lamps, on the contrary, the magnet becomes inoperative, the switch or bridge piece falls or swings round, and the pilot lamp is again rendered incandescent. The advantage of this automatic arrangement is, that sufficient light is afforded by the pilot lamp to enable the position of the local detachable lamp sockets to be easily found, and when the lamps have to be detached and removed elsewhere, there is no necessity to grope for the door in the dark.

5716. "Improvements in the method of measuring electric currents." A. WRIGHT. Dated March 31. 4d. The pole pieces of one or two bars of iron, magnetised either by one or two coils, through which the whole or part of the current to be measured passes repel the pole pieces of like polarity against an opposing force such as gravity. The amount of motion consequent on this repulsion forming the measure of the current required.

5738. "Improvements in printing telegraphic apparatus." C. J. A. MUNIER. Dated March 31. 8d. Relates to printing telegraph instruments, and it consists essentially in the addition to apparatus of the class known as the Hughes printing telegraph of certain mechanism hereinafter described, which enables these apparatus to act as multiple or multiplex telegraphs.

5922. "Improvements in galvanic batteries." J. RAPIEFF. Dated April 4. 4d. The inventor uses oxides of metals, or metaloids, sub, proto, mono, bi, tetra, ses-qui, peroxide or their hydrates, or any mixture of them, in combination with salts, or acids, or other chemical combinations, one or several of them which under chemical action of the substances used in batteries, or their products, or by electrical action, or by their joint action, are capable of yielding chlorine, iodine, bromine, fluorine, oxygen, phosphorus, sulphur and such like, in a more or less pure state, or their mixtures or chemical combination between themselves and other substances. These arrangements can be used with any description or form of electrodes, with or without the addition of metals, or vegetable, animal, or mineral charcoal, or carbon, or coke, in granulated or such like form, and may be applied to any form of batteries or cells. The electrodes may be made porous, or with holes or openings, or other contrivances, to assist the supply and retain the charges of the said bodies, which can be supplied by simple addition, or by sending into, or near the electrodes, a current, or currents of the said substances, from a suitable receptacle, or generator inside or outside of the cell, in gaseous, liquid, or solid form. The electrodes may have special chambers where the said bodies can be generated by chemical action, with or without the assistance of electricity, and where the said bodies, or substances capable of generating them, may be stored.

6064. "Improvements in instruments for measuring electricity." L. B. MILLER. Dated April 7. 6d. The inventor takes a very light strip of soft iron (hereafter called the needle) and passes it through a hole bored in the centre of another piece, of the same length, but considerably thicker, pivoting it so that it can turn about its centre. Around the centre of the two pieces of iron for conveying the electric current is wound insulated wire, the resistance and method of joining up of which varies in a manner well understood, according as it is desired to measure ampères, volts, or volt-ampères. The bobbin on which this is wound is so shaped that while the wire is brought as near the iron as possible it will not prevent the needle deflecting through an angle of, say, 45°. When an electric current is passed through the coil the lower end both of the soft iron needle and the thicker piece of iron become magnetised with, say, N polarity, and the upper ends of both with S polarity. The needle is therefore repelled at both ends, and turns round on its pivot away from the fixed piece through an angle depending on the current passing through the coil, the proximity of the deflected needle to the wire, the weight tending to bring the needle back to zero, &c.

6260. "A new or improved method of electrical distribution." W. H. SCOTT and E. A. PARIS. Dated April 10. 4d. According to this invention a high tension current is produced at one or more stations, which stations may be advantageously placed outside the town or place to which the electrical energy is to be supplied, whether for purposes of illumination or motive power. The high tension current is led off by means of wires or mains to convenient centres, where it is transformed into low tension electricity by means of transformers. These transformers consist of field magnets, as in dynamos or motors, and a revolving armature, which is wound with two sets of conductors, one set for the high tension current and the other set for the low tension current.

6261. "Improvements in dynamo-electric machines." W. H. SCOTT and E. A. Paris. Dated April 10. 6d. Relates to dynamo-electric machines of the kind described in the Provisional Specification accompanying an application for a patent No. 4683 of 1884, and it has for its object the improvement in the construction of armatures for dynamo-electric machines. According to this invention, the revolving drum-shaped armature has its ends formed as described in the specification hereinbefore referred to, but instead of being wound with wire strips of copper, are laid longitudinally from end to end of the drum. The strips of copper are connected to strips placed at points on the circumference of the drum nearly equal to but a little more or less than the distance between the centres of the magnets used. Each end of the copper strips are bent down over the end of the drum. The strips are connected together as follows:—Each bent-down end of each copper strip is soldered to a turned-up part at one end of a thin curved flat copper plate. This flat plate is formed by cutting a piece of thin sheet copper in a circular form, but with a part at each end of greater width than its middle part, or as it were with a part of its outside edge cut away between the ends. This plate, when there are four magnets, is slightly longer than the quadrant of the circle of the drum end, and is curved to correspond to the circle of the drum. At one end a small oblong piece is cut away on the side nearest the axis of the drum, and the oblong part at the end left is bent at right angles, and it is to this bit that the end of the longitudinally laid strip is soldered. At the opposite end of the curved plate a small oblong piece is turned up from the portion nearest the cut-away part, and to this bit is soldered the bent-down end of another copper strip laid longitudinally along the drum at a part along its circumference nearly at right angles to the strip fastened to the other end of the curved plate. The copper strips are so connected that a strip, 1, at one end of the curved flat plate is connected through it to another strip, 2, laid longitudinally at a part on the circumference of the drum distant from the strip, 1, equal to the distance between the centres of the magnets. This strip, 2, is connected at the other end of the drum by another curved flat plate to another strip, 3, similarly placed at the same distance to No. 2, and No. 3 is again connected, but at the opposite end of the drum, to another strip, 4, and so on, until the surface of the drum is covered. The copper strips and curved plates are all properly insulated from one another.

6275. "Improvements relating to the propulsion of tramcars and other vehicles by electricity." A. RECKENZAUN. Dated April 12. 6d. The inventor employs two, or, if necessary, more than two, motors, which, when working together, will give the necessary power for starting the vehicle and for mounting inclines; and also to ensure that, when running on a level road, the work of one only of such motors will be sufficient. These several motors may be alike in size, or they may be different, but their number of revolutions are made to correspond according to the gearing employed. By means of a switch he can run the several motors "in parallel," or "in series," or singly, and thereby change the resistance of the circuit and with it the speeds of the machines. The gearing is so arranged that either one of the motors can drive the car in either direction should one of the motors become disabled. If he employs two motors, he provides the shaft of each with a worm, which worm gears into a worm wheel threaded upon the car axle.

6404. "A method of and apparatus for determining the time constant of an electrical circuit." T. H. BLAKESLEY. Dated April 16. 6d. The inventor causes a permanent magnet to revolve rapidly within an annular coil, which is in the plane of the axis of revolution of the magnet, and can be turned round that axis and set at any point indicated on a scale. On the axis of the magnet is a commutator, consisting of two insulated plates, against which bear brushes or rubbers, fixed in position, and connected to a galvanometer. The annular coil is connected in the circuit whose time constant has to be determined and to the two plates of the commutator. The revolution of the magnet sets up in the coil alternating undulating currents, which are converted by the commutator so as to be indicated on the galvanometer. By turning the coil round relatively to the diametral plane passing through the contacts of the commutator brushes, and observing the indications on the galvanometer, knowing also the angles which the plane of the coil makes with the plane of the brush contacts and the speed at which the magnet revolves, the time constant of the circuit can be computed.

6566. "Improvements in mounting electric incandescence lamps." A. M. CLARK. (A communication from abroad by J. M. A. G. Lescuyer, of Paris.) Dated April 19. 6d. Fig. 1 represents in elevation a lamp unmounted, and fig. 2 an end view of the same. *a*, *a*, are a pair of semi-sheaths for the neck of the bulb. These sheaths are stamped out of thin sheet metal, their lateral edges being formed with tongues, *b*, alternated with recesses, *c*, of greater width than the tongues, so that when the sheaths are bent so as to embrace the cylindrical neck of the bulb, the tongues, *b*, of the one sheath will enter the recesses, *c*, of the other, the tongues being of such length that each sheath will embrace an arc of the circumference of, say, at least 200 degrees without the sheaths touching one another. The sheaths thus clip the neck of the bulb sufficiently to ensure their retention thereon, and may be sprung on and off. Each sheath, *a*, is provided with an ear, *d*, at its extremity, to which the respective platinum wires, *e*, are soldered, whereby they are prevented from slipping up and down on the neck. Each sheath is also formed with a central longitudinal rib, *f*, terminating in an enlargement or boss, *g*, for engagement with the socket of the holder, as hereafter described. The holder consists of a pair of spring clips fixed to a cylindrical base of ebonite or other insulating material, provided with a coned screw stem for fixing into gas brackets or other supports; the clips being respectively connected to the two parts of the circuit by wires which may either be visible or be concealed by passing through the base. The clips constituting the holder or socket are also stamped out of sheet metal, and are of approximately quarter round section, each embracing only the solid portion of the sheaths. Each clip is formed with a central longitudinal groove and recess to receive the rib and boss on the sheaths above mentioned, whereby the correct position of the lamp in its socket is insured, and it is securely retained and prevented from turning, so that lamps may be fixed in any position without danger of falling out. The clips are bowed outwards, and slotted in order to impart the necessary elasticity to the holding part which forms the socket. At the lower end they are bent to a half round form to embrace the cylindrical base to which they are screwed.

FIG. 1.

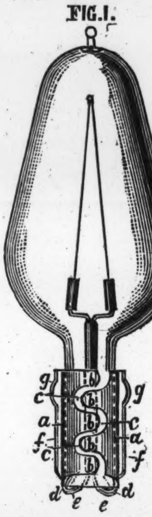
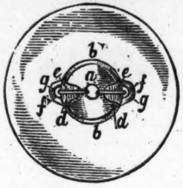


FIG. 2.



TO CORRESPONDENTS.

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CORRESPONDENCE.

Mackenzie's Patent Electric Bell Indicator.

I notice in your issue of the 25th April that you describe my Patent Electric Bell Indicator, now in the hands of Messrs. Woodhouse and Rawson, and at the end of the notice remark, "We cannot help expressing our doubts as to their usefulness." I can scarcely agree with you as to the justice of such a remark, for I think you can hardly forget that ever since electric bells were invented the principal objection raised by everyone to their use has been that no means existed of knowing whether the bell has rung when the push button has been pressed, such observations being constantly made in hotels and clubs which are fitted with this system of calling attention. Brequet was the first, I believe, to try and overcome this defect, and his needle indicator is, perhaps, known to you. However, its cost was prohibitory, and it was that which led to the design of the present little instrument, the extra cost that would be incurred by its use in an installation of electric bells being infinitesimal. That the instrument has been considered of use is proved by the curious amount of notice that has been taken of it in papers and journals whose *metier* is certainly not the diffusion of electrical knowledge. You also say that persons must necessarily be informed of its object. This, I venture to say, is not correct, the fact of *hearing* the bell ring, as it were, speaking for itself. That such an instrument is wanted is also shown by the fact that a patent has lately been taken out for an Indicator, which *pricks* the finger of the person who rings the bell, the inventors seemingly preferring to rely upon physical impressions rather than psychological sensations.

J. Kenneth D. Mackenzie.

15, Great George Street,
Westminster, S.W., *May 4th.*

Patents for Electric Lighting.

I observe your note concerning the Sawyer-Man patent of 1878 in your issue of this week. I have long wondered at the silence regarding this patent, as I have always looked upon it as controlling the present method of manufacturing incandescent electric lamps. It seems that "flashing," or some equivalent process, is absolutely necessary in the manufacture of lamps, and it appears to me that two patents, both of them old ones, as electrical matters go, cover the whole ground. These are the one above mentioned, and that of Lorrain, No. 2848, dated 29th June, 1881, which seems to cover any process equivalent to that of "flashing" effected by chemical means. I am not aware if these two patents are in the same hands, but if they are, we appear to be in danger of a monopoly which might become as galling as that of the telephone.

Looker On.

May 6th, 1885.

Winding Dynamos.

When one person ventures to criticise the writings of another, I think it will be admitted by anyone that he should in common fairness deal *seriatim* with the formulæ given and endeavour to show whence the error arose and how perpetuated.

But Mr. Esson in his first communication, instead of attempting to analyse my reasonings and formulæ, contented himself with merely denying them, and he proceeded, moreover, to give figures as results, without indicating in the slightest degree how he arrived at such results.

However satisfactory this may be to Mr. Esson, it can hardly satisfy the scientific reader, nor is it altogether acceptable to myself.

However, in his second communication, Mr. Esson proceeds to refute my arguments—in a few words. Had he confined himself to his brilliant display of rhetoric, he would undoubtedly have crushed me, but since he has now been kind enough to give the formulæ and rules on which he bases his calculations, I am in a position to show the majority of the readers of this journal (although I shall probably fail to convince Mr. Esson) that both his rules and figures are totally incorrect.

Taking my formula $R_1 = \frac{L^2}{R}$, Mr. Esson replaces the known letter L by two others, $\frac{E}{C}$, producing

$$R_1 = \frac{E^2}{C^2 R}, \qquad (1)$$

he also replaces L by $\frac{E}{C}$ and R by $\frac{E^2}{C^2 R_1}$ in the equation $r_1 = r\left(\frac{L}{L+R}\right)^2$ transforming it into the equation

$$r_1 = \frac{r C^2}{\left(C + \frac{E}{R}\right)^2} \qquad (2)$$

But it is difficult to see what possible reason Mr. Esson could have had for thus unnecessarily complicating the formulæ, and making it, moreover, necessary to determine R_1 before r_1 could be known. He furthermore by adding his first two equations ((2) and (3)), arrives at the unsymmetrical equation

$$C^2 (R + r) = \frac{E^2}{R_1} + \left(C + \frac{E}{R_1}\right)^2 r_1$$

from which he says R_1 must be determined. But as Mr. Esson has already given $R_1 = \frac{E^2}{C^2 R}$, why does he want another formula, and is he sanguine enough to expect that he can obtain from his last equation a value of R_1 numerically different from that which would be obtained by using the equations from which he derives his last formula.

Mr. Esson next proceeds to say that I ought to know *that the excitation given the magnets depends upon the number of convolutions, and that by varying the gauge of the wire we may have any number of convolutions and consequently any excitation we please, keeping the resistance unaltered.* And yet I am still under the impression that when the number of convolutions on the bobbin is altered, that the resistance of the wire will vary as the square of the number of convolutions, if, of course, a correction is made for discrepancies introduced by the insulation of the conductor.

In line 3 of the second column, page 411, Mr. Esson quotes me as using the word *independent*, the word I used being *interdependent*; but I presume this is a printer's error.

After agreeing with me *that neither the work in the armature nor field-magnet can be changed without the one varying as a function of the other*; Mr. Esson says, *having settled what the ratio between the work done in the magnets and that done in the armature shall be, we determine the windings accordingly.* But I still maintain that the proportion between the work done in the armature and that done in the field-magnets is determined by the method of winding, that is, by the resistance given to the armature and magnets. As this seems to be the question that first induced Mr. Esson to enter upon this controversy with me, I will express my theory of the matter as concisely as I can, thus :—

Given two dynamos correctly designated, and of similar shape but differently wound, it is required to furnish to the exterior circuits a given current at the same difference of potential at the terminals, both dynamos having the same speed, and expending the same internal work. Now I maintain that to do this, the current's density in similar parts of each dynamo must be the same ; that is, since the work expended in the different parts of the dynamos is proportional to the square of the density of the current at those points, therefore the work expended in similar parts of each dynamo must be the same. I should feel deeply interested in any argument that could prove it was possible to obtain the same total work without having the current's density at similar parts of the two machines the same.

Mr. Esson's opinion is that the two dynamos may have similar resistances given to their armatures and that the total internal work may be the same, although the component parts are different in the dynamos.

I can only add in conclusion, to Mr. Esson's communication, that I regret that my strictures on his valuable labours should be deemed by him personal, ungrammatical and in bad taste, and I hasten to assure him that for the future I shall adopt his own modest and far from egotistical style of writing.

On the same page as Mr. Esson's last communication there is an article by Mr. Snell that gives an interesting account of a method of re-winding the field-magnet of a dynamo, based on a rule given him by Mr. Swinburne ; but as the conditions differ from mine, inasmuch as the external work and speed are altered, Mr. Snell's paper does not call for a reply by me.

W. Moon.

May 2nd, 1885.

Text Books on Electrical Measurements, &c.

I shall feel much obliged if you can inform me in one of your early numbers what is the best text book on electrical measurements, defining and explaining in the simplest manner the ohm, volt, ampère and watt. What I am now desirous of knowing is the amount (grains) of copper that would or should be deposited from a solution of sulphate of copper in good working order by 1 or 100 ampères of 1 or 100 volt force (either in a single tank or in a series).

I presume the one (volt) cannot exist without the other (ampère). "What, then, is the watt ?"

Thanking you much in anticipation,

Novice.

Birmingham, *April 24th*, 1885.

[Prof. Thompson's "Elementary Lessons in Electricity and Magnetism" will give our correspondent all the information he requires.—EDS. ELEC. REV.].

The Grouping System in Electric Lighting.

In the report on Electric Lighting contained in your issue of April 25th, allusion is made to an important modification of the grouping system, in which secondary cells are utilised as regulators for balancing the circuit. (See page 374, fig. 2.)

Allow me to remark that the figure and description of this system are almost identical with my patent of 5th May, 1882, No. 2128, which has now become public property, and consequently available for general use.

In cases where lamps or series of lamps are required to be turned off and on the arrangement undoubtedly possesses many advantages.

W. Arthur.

42, Brook Street, W., *May 6th*.

[We have examined the specification of Rear-Admiral Arthur, and we find his arrangement to be identical with that described by Mr. W. H. Preece in his report on Electric Lighting.—EDS. ELEC. REV.].

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